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# TM 8-623

WAR DEPARTMENT TECHNICAL MANUAL

U.S. Dept. of Army

## **ANESTHESIA**

### **APPARATUS, PORTABLE**

### **(ITEM 9350000)**



WAR DEPARTMENT • JANUARY 1945





WAR DEPARTMENT TECHNICAL MANUAL  
TM 8-623

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ANESTHESIA  
APPARATUS, PORTABLE  
(ITEM 9350000)

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WAR DEPARTMENT • JANUARY 1945

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For explanation of symbols, see FM 21-6.



# CONTENTS

Paragraph Page

## PART ONE. INTRODUCTION.

### Section I. General.

Scope .....	1	1
Records .....	2	1

### II. Description and Data.

Description .....	3	1
Data .....	4	1

### III. Tools and Parts.

Tools .....	5	1
Parts .....	6	2

## PART TWO—A. OPERATING INSTRUCTIONS (McKESSON).

### Section IV. General.

Scope .....	7	3
New equipment .....	8	3
Used equipment .....	9	7

### V. Controls and Instruments.

Controls .....	10	7
Instruments .....	11	8

### VI. Operation Under Usual Conditions.

General .....	12	8
Preparation for operation .....	13	8
Operation .....	14	9

## PART TWO—B. OPERATING INSTRUCTIONS (HEIDBRINK).

### Section VII. General.

Scope .....	15	11
New equipment .....	16	11
Used equipment .....	17	15

### VIII. Controls and Instruments.

Controls .....	18	15
Instruments .....	19	17

### IX. Operation Under Usual Conditions.

General .....	20	17
Preparation for operation .....	21	17
Operation .....	22	18

## PART THREE—A. MAINTENANCE INSTRUCTIONS (McKESSON).

### Section X. General.

Scope .....	23	20
-------------	----	----

### XI. Special Organizational Tools and Equipment.

General .....	24	20
---------------	----	----

### XII. Lubrication.

Lubrication .....	25	20
-------------------	----	----

### XIII. Preventive Maintenance.

General information .....	26	20
Before operation services .....	27	20
After operation services .....	28	21
Monthly operation services .....	29	21

III

	<i>Paragraph</i>	<i>Page</i>
<b>XIV. Trouble Shooting.</b>		
Valve or moving part becomes sticky or does not operate smoothly .....	30	21
Leak in apparatus .....	31	21
Flowmeter does not drop to "0" position when needle valve is shut off.....	32	21
Squealing noise comes from regulator.....	33	21
High pressure gauge does not return to "0" when gas is off	34	22
Safety valve on regulator pops off.....	35	22
Needle valves do not shut off flow of gas to flowmeter....	36	22
<b>XV. Maintenance Operations.</b>		
To sterilize rubber parts .....	37	22
To clean apparatus .....	38	22
To find and repair leaks in apparatus .....	39	23
To repair needle valve .....	40	26
To repair flowmeter .....	41	26
To remove and replace ether jar and wick.....	42	27
To repair absorber .....	43	27
To repair regulator .....	44	27
To replace regulator tubing connections .....	45	30
To repair yoke check valve .....	46	31

### **PART THREE—B. MAINTENANCE INSTRUCTIONS (HEIDBRINK).**

#### **Section XVI. General.**

Scope .....	47	32
-------------	----	----

#### **XVII. Special Organizational Tools and Equipment.**

General .....	48	32
---------------	----	----

#### **XVIII. Lubrication.**

Lubrication .....	49	32
-------------------	----	----

#### **XIX. Preventive Maintenance.**

General information .....	50	32
Before operation services .....	51	32
After operation services .....	52	33
Monthly operation services .....	53	33

#### **XX. Trouble Shooting.**

Any valve or moving part becomes sticky or does not operate smoothly .....	54	33
Leak in apparatus .....	55	33
Flowmeter does not drop to "0" position when needle valve is shut off.....	56	33
High-pressure gauge does not return to "0" when gas is off	57	34
Safety valve on regulator pops off .....	58	34
Needle valves do not shut off flow of gas to flowmeter....	59	34

#### **XXI. Maintenance Operations.**

To sterilize rubber parts .....	60	34
To clean apparatus .....	61	34
To find and repair leaks in apparatus .....	62	35
To repair needle valve .....	63	37
To repair flowmeter .....	64	38
To remove and replace ether jar and wick .....	65	40
To repair high-pressure tubing .....	66	40
To repair absorber assembly .....	67	40
To repair regulator .....	68	42
To repair yoke intake .....	69	47
To repair face inhaler Y .....	70	47



## PART ONE

### INTRODUCTION

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#### Section I. GENERAL

##### 1. Scope

*a.* These instructions are published for the information and guidance of the personnel to whom this equipment is assigned. They contain information on the operation and maintenance of the equipment. They apply to item No. 9350000, anesthesia apparatus, portable, and are arranged in three parts: Part One—Introduction; Part Two—Operating Instructions; and Part Three—Maintenance Instructions.

*b.* All requisitions for spare parts should be submitted in accordance with latest ASF Supply Catalog Med-7.

##### 2. Records

No records are required to be kept on this apparatus except as may be designated by the medical officer in charge.

#### Section II. DESCRIPTION AND DATA

##### 3. Description

*a.* GENERAL. The anesthesia apparatus, portable, is a two-gas anesthesia apparatus packed completely in a carrying case. It can be used in the case itself or removed and mounted on a mobile base.

*b.* MANUFACTURERS. (1) McKesson Appliance Co., Toledo, Ohio.

(2) Heidbrink Division of the Ohio Chemical & Mfg. Co., Minneapolis, Minn.

##### 4. Data

The following features are incorporated in the portable anesthesia apparatus:

*a.* Provision for the administration of nitrous oxide and oxygen or any mixture of the two by the closed circuit or fractional re-breathing method.

*b.* Provision for the administration of ethyl ether with nitrous oxide and oxygen mixture.

*c.* Provision for adding ethyl ether during operation.

*d.* Provision for changing gas cylinders during operation.

#### Section III. TOOLS AND PARTS

##### 5. Tools

*a.* Tank and yoke wrench.

- b.* Spanner wrench for removing absorber check valve window retaining ring (McKesson only).
- c.* Adjustable wrench.

**6. Parts**

- a.* High pressure cylinder valve adapter (7789000) to permit use of large size commercial oxygen cylinders.
- b.* Extra gaskets and washers are provided with each apparatus.
- c.* One extra soda lime canister with cover.



## PART TWO — A

### OPERATING INSTRUCTIONS (McKESSON)

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#### Section IV. GENERAL

##### 7. Scope

Part Two—A contains information for the guidance of the personnel responsible for the operation of the portable anesthesia apparatus, McKesson model No. 675 with the description and location of the controls and instruments.

##### 8. New Equipment

*a. UNCRATING.* (1) Open shipping box carefully.  
(2) Remove paper packing to uncover carrying case.  
(3) Lift the carrying case out of the shipping box by the handle on top of the case.

*b. UNPACKING FROM CARRYING CASE AND ASSEMBLING.* (1) Release the two hooks on each side of the bottom of the carrying case. Lift the top part of the case off which will expose the operating head with the gauges attached, absorber head with ether vaporizer attached, spare absorber canister and base stand.

(2) Release the two hooks on the lid. Lift the lid to expose rubber parts, upright of base stand and accessories.

(3) Remove all parts from wrapping papers, checking carefully to see that no parts are discarded with the wrapping material.

(4) Remove head, absorber, and ether vaporizer assembly by loosening wing screw which secures it to the base casting and lifting it from its cradle in the base of the carrying case.

(5) When apparatus is to be used outside of case—

(*a*) Loosen the four thumbscrews on the clamps that hold the base casting to the bottom of the carrying case.

(*b*) Turn the retaining pieces sideways and lift off the base casting.

(*c*) Pull the caster locks outward.

(*d*) Remove the casters, invert them and place in the base casting.

(6) Remove the base upright tube from the upper section of the carrying case.

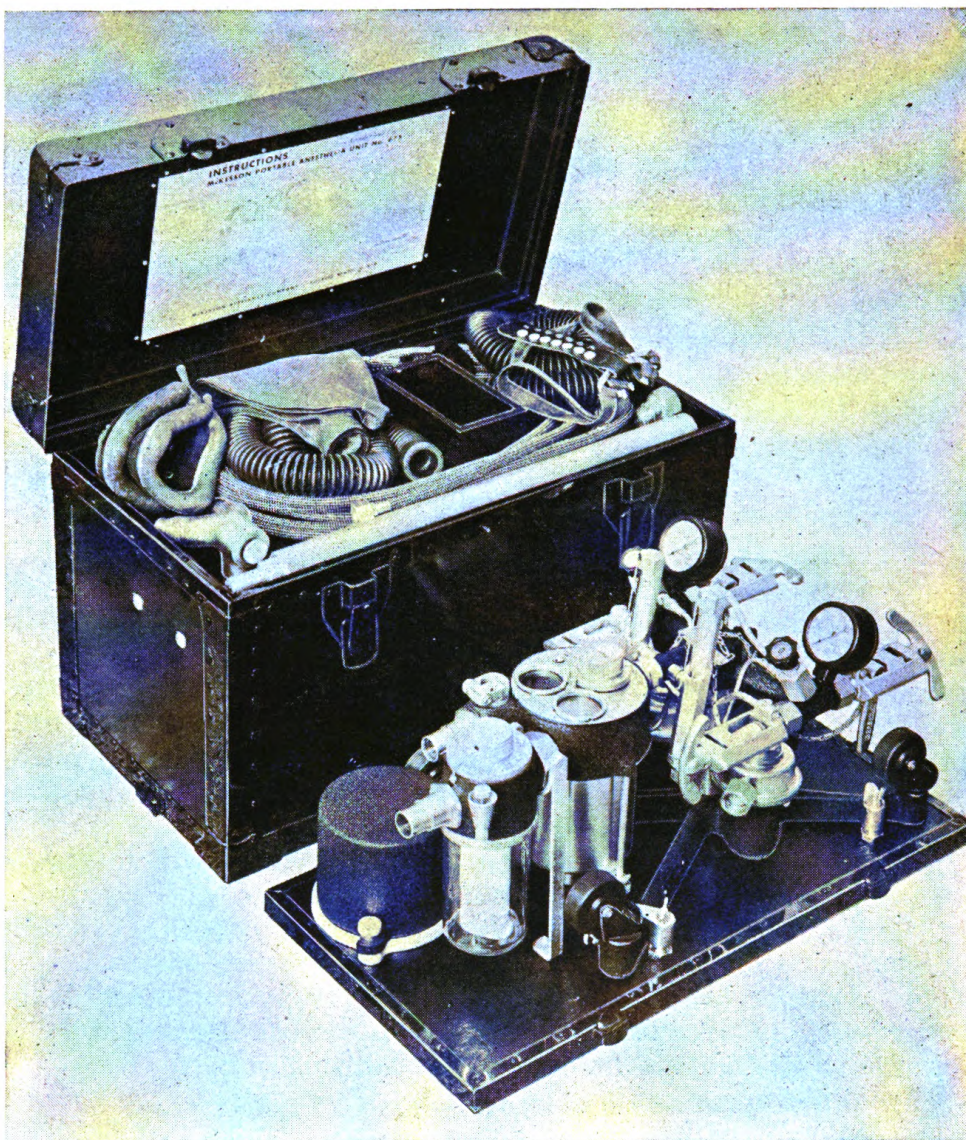
(7) Screw the base upright tube tightly into the base casting.

(8) Attach head assembly to the top of the upright tube. Tighten by turning wing screw clockwise. It should fit into hole in upper part of base stand upright.

(9) Attach corrugated inhaler tubing to head assembly.

(10) Attach face inhaler Y to end of breathing tubes.

(11) Insert the rubber face mask to be used into the face inhaler Y.



*Figure 1. Portable anesthesia apparatus, McKesson model No. 675, packed in carrying case.*

(12) Place the rebreathing bag on the absorber fitting provided. (See fig. 2.)

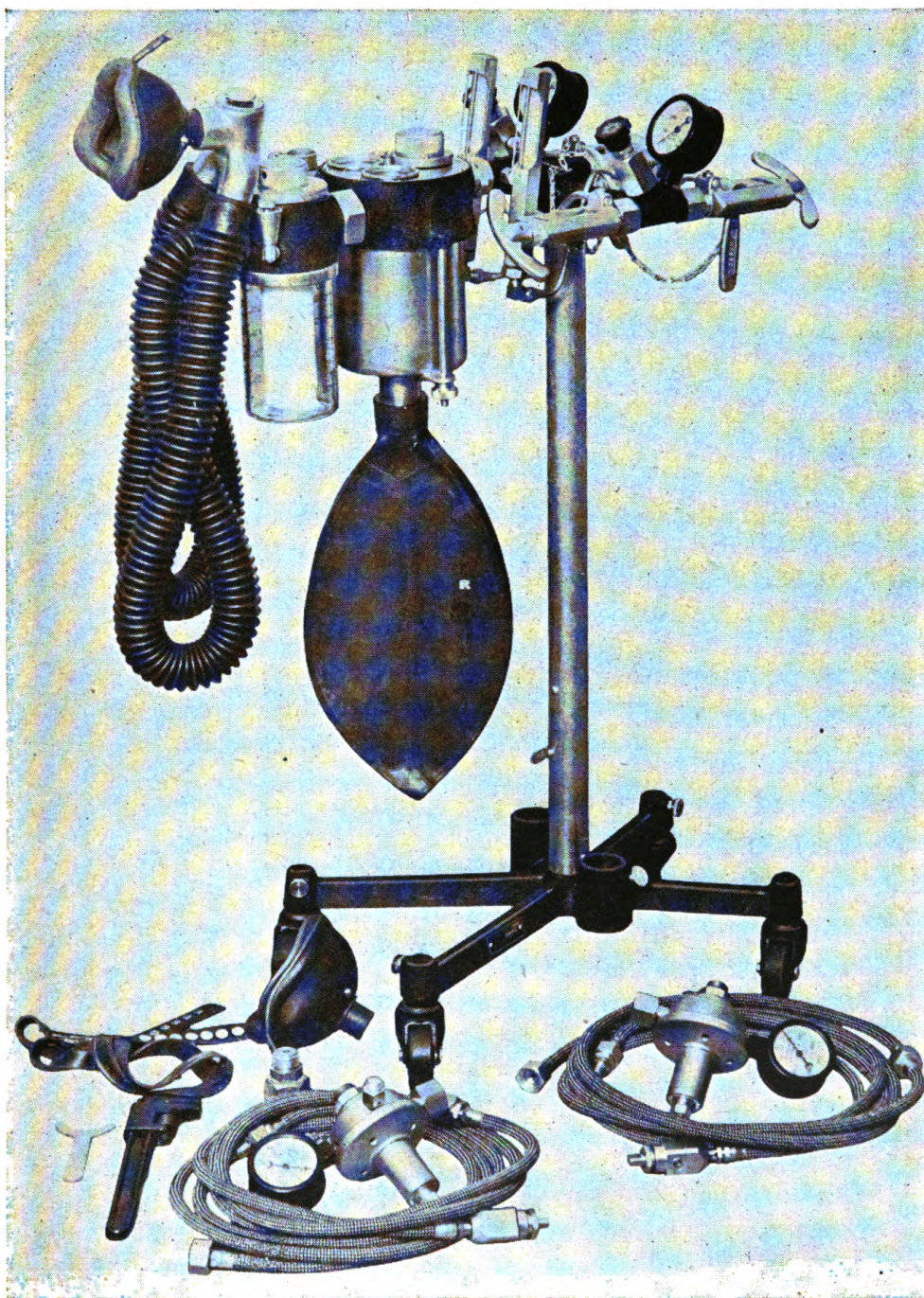
(13) In connecting cylinders to the apparatus, it is important that the cylinders are connected to their proper yokes, that is, the oxygen cylinder to the oxygen yoke and the nitrous oxide cylinder to the nitrous oxide yoke. (See AR 850-60, for further information on gas cylinders.)

(14) If small cylinders are used—

(a) Remove any protective tape from cylinder valve and open the valve to blow out any dirt particles in the valve aperture.

(b) Remove all old washers in the yoke. If this is not done, the yoke may be damaged and the threads in the yoke handle may be





*Figure 2. Portable anesthesia apparatus, McKesson model No. 675, assembled.*

stripped by bringing great force on the cylinder in an effort to prevent a leak.

(c) Place a new washer in the small cylinder yoke. Use one washer only, making sure it is a small fiber washer (9R03134).

(d) Place cylinder in yoke.

(e) If one cylinder of each gas is used, keep empty intercom-

municating yoke plugged tightly with yoke plug. A small fiber washer is used with the yoke plug.

(f) If two cylinders of the same gas are used in the intercommunicating yokes, open only one at a time.

(15) If large cylinders are used—

(a) Open the valve to blow out dirt particles that may be in the valve aperture. At this time note whether the cylinder valve outlet is commercial or medical. The large medical oxygen cylinder valve outlet is a  $\frac{1}{2}$ -inch threaded fitting having a flat facing with two concentric indentations. The oxygen regulator provided with this apparatus will fit directly to this fitting after a large fiber washer (9R03136) has been put in place between the regulator and cylinder. However, in order to apply the oxygen regulator to a commercial oxygen cylinder which has a  $\frac{7}{8}$ -inch threaded outlet with a cupped face, a high pressure cylinder valve adapter (7789000) is necessary. No washer is placed at the cylinder-adapter union since it is a ground metal-to-metal connection. However, a washer must be placed at the union of the regulator and adapter.

(b) Attach the regulator tubing to the bottom of the regulator, using a small fiber washer at this union.

(c) Attach the nitrous oxide regulator to the large nitrous oxide cylinder, using a washer at this union. Blow dust particles out of cylinder valve before attaching. All nitrous oxide large cylinder valve outlets are the same.

(d) Check regulator screen for dust particles or enlarged perforations, and clean or replace if necessary.

(e) Attach nitrous oxide high pressure tubing.

(f) The other end of the regulator tubing, which is attached to the shut-off valve is then placed in position in the small cylinder yoke on the machine head. Use the same precautions in placing the shut-off valve in the yoke that are used with a small cylinder.

(g) Always make sure that large cylinders are properly secured against falling if used in the upright position.

(16) If a large cylinder is being used and there is a small cylinder in the yoke opposite the regulator tubing shut-off valve, great care must be exercised to turn the regulator tubing shut-off valve completely off before opening small cylinder valve. If this caution is not observed and for some reason the check valve in the intercommunicating yoke does not seat properly, the gas from the small cylinder will travel through the large tank regulator tubing and may result in damage to the regulator and injury to personnel.

c. DISASSEMBLING AND PACKING IN CARRYING CASE. (1) Remove cylinders, regulators, and rubber parts from the apparatus.

(2) Loosen wing screw which holds head assembly by turning counterclockwise, and remove head assembly.

(3) Unscrew the base upright tube from the base casting.

(4) Replace the base upright tube in the upper section of the carrying case.

(5) Replace base casting if used outside of carrying case.



- (a) Pull the caster locks outward.
- (b) Remove the casters, invert them and place them in base casting.
- (c) Turn the retaining pieces sideways and replace the base casting.
- (d) Tighten the four thumbscrews that hold the base casting to the bottom of the carrying case.
- (6) Place regulators in the holder on the base casting.
- (7) Replace head assembly in its cradle in the base of the carrying case.
- (8) Tighten wing screw which secures head assembly to the base casting.
- (9) Close lid and secure by the two hooks on the lid.
- (10) Replace top part of carrying case and secure with two hooks on each side of the bottom of the carrying case.

## 9. Used Equipment

The procedure for new equipment applies also to used equipment.  
(See par. 8.)

## Section V. CONTROLS AND INSTRUMENTS

### 10. Controls

a. FLOWMETER NEEDLE VALVE (OXYGEN OR NITROUS OXIDE). The flowmeter needle valve regulates the flow of gas through the apparatus.

b. ABSORBER CONTROL KNOB. The absorber control knob regulates the proportion of the inhaled gases from the rebreathing bag which pass through the soda lime.

c. ETHER VAPORIZER CONTROL KNOB. The ether vaporizer control knob regulates the proportion of gases being breathed which pass through the vaporizer.

d. REGULATOR ADJUSTING SCREW. The regulator adjusting screw regulates the pressure from the regulator to regulator tubing. The regulator reduces the pressure coming from the gas cylinder to a pressure of about 50 pounds per square inch.

e. FACE INHALER Y SHUT-OFF VALVE. The face inhaler Y shut-off valve controls the passage of gas between the breathing tubes and the face mask. When in the open position, the knurled head thumbscrew is turned counterclockwise as far as it will go and the patient breathes into the apparatus. When in the closed position the knurled head thumbscrew is turned clockwise as far as it will go and the patient breathes into the atmosphere and the breathing tubes are shut off.

f. EXHALING VALVE. The exhaling valve limits the pressure in the breathing system.

g. CYLINDER VALVE. The cylinder valve opens or closes the gas cylinder.

*h.* **REGULATOR TUBING SHUT-OFF VALVE.** The regulator tubing shut-off valve controls the flow of gas from the regulator tubing into the operating head.

## **11. Instruments**

*a.* **HIGH PRESSURE GAUGES (OXYGEN AND NITROUS OXIDE).** The high pressure gauge indicates pressure in the gas cylinder. When a large cylinder is used with this apparatus, the pressure in the cylinder will show on the high pressure gauge on the regulator. The high pressure gauge on the apparatus head will not register when the large cylinder is used. This gauge will register when the small cylinders are being used.

*b.* **ETHER VAPORIZER DIAL.** The ether vaporizer dial indicates what fraction of the gases inhaled are being exposed to ether. When the ether vaporizer control is set at "OFF," no vapors are carried to the patient. When set at "1," one part of the breathing goes to the vaporizer and seven parts bi-pass the ether vaporizer. When set at "4," one-half of the breathing goes to the vaporizer and when set at "ON," all of the breathing goes through the vaporizer.

*c.* **FLOWMETER (OXYGEN AND NITROUS OXIDE).** The flowmeter indicates the amount of gas in liters per minute that is being delivered to the patient from the cylinder.

*d.* **ABSORBER CONTROL DIAL.** The absorber control dial indicates the fraction of the inhalations going through the soda lime. When the indicator is set at "OFF," the soda lime is bi-passed by the gases. When the indicator is set at "0" the breathing is going into the absorber and rebreathing bag, however, it is bi-passing the soda lime on the patient's inhalation. When the indicator is set at "ON," all the inhalations go through the soda lime. At "2," one-half of the inhalation goes through the soda lime, at "1," one-fourth and at "3," three-fourths.

*e.* **PRESSURE LIMITING DIAL.** The pressure limiting dial is a small wheel on the side of the exhalation valve. It is graduated "0," "5," "10," "20," which indicates pressure in millimeters of mercury. The pressure in the breathing system will be limited to the pressure for which the dial is set and pressure in excess of the setting will bleed out through the exhalation valve.

## **Section VI. OPERATION UNDER USUAL CONDITIONS**

### **12. General**

The technique of operating the anesthesia apparatus, portable is left to the discretion of the medical officer in charge. However, the technique outlined in paragraph 14 is that recommended by the manufacturer of this equipment. It is offered as a guide only.

### **13. Preparation for Operation**

*a.* **FILL SODA LIME CANISTER.** (1) Loosen two knurled nuts

which hold the soda lime canister cover by turning clockwise.

(2) Remove bag assembly holder by turning clockwise and lowering. This exposes the canister proper which is removed by turning slightly clockwise and lowering.

(3) Fill canister with 4-8 mesh soda lime. A fine mesh soda lime increases resistance in the breathing circuit, a condition which is not to be desired.

(4) Replace canister and bag assembly holder. Tighten knurled nuts.

b. CHECK SODA LIME ALREADY IN THE MACHINE. It is suggested that before operating a unit which has already been set up, the soda lime in the canister be inspected to make sure that it is not caked or excessively moist. The efficiency of excessively moist soda lime may be restored by heating for a few minutes to drive out the excessive moisture. The life of soda lime varies from 1 to 8 hours of usage and should be replaced at the end of that time.

c. FILL ETHER VAPORIZER. (1) Turn control knob to "Fill."

(2) Remove funnel plug.

(3) Pour ether into funnel until the glass jar is filled to the desired level but in no case above the maximum level line.

(4) Replace funnel plug, making sure funnel plug washer is in place.

#### 14. Operation

a. Close both flowmeter needle valves on the operating head.

b. Open one nitrous oxide and one oxygen cylinder valve two or three complete turns.

c. Set absorber control knob to the "0" position.

d. Close exhaling valve on absorber unit by turning pressure limiting dial counterclockwise to the maximum position.

e. Close shut-off valve in face inhaler Y. (See par. 10e.)

f. Fill rebreathing bag three-fourths full of nitrous oxide. When shutting flowmeter needle valves off, turn down needle valve gently until flowmeter indicating rod settles to the bottom of the scale and no more. It is not necessary to turn the flowmeter needle valve down tight as this practice causes excessive wear on the needle valve stem.

g. Apply head harness. The part marked "TOP" goes at the top of the head.

h. Hold face mask lightly on the patient's face.

i. Open shut-off valve in face inhaler Y.

j. Set oxygen needle valve so the oxygen flowmeter indicates 200 to 300 cc of oxygen per minute.

k. As soon as anesthesia is established, it is well to close the shut-off valve in the face inhaler Y and empty the rebreathing bag by pressing on it. This will force the bag contents out which eliminates nitrogen from the circuit. Then quickly refill the bag with nitrous oxide as before. Open the shut-off valve in the face

inhaler Y and continue oxygen flow at approximately 250 cc per minute.

*l.* At this point, open absorber control valve to remove the carbon dioxide from the mixture. The further the valve is advanced towards the "ON" position the more carbon dioxide will be removed from the patient's exhalations.

*m.* It will not be necessary to continue the nitrous oxide flow for quite some time unless gas in the bag is lost due to poor application of the face mask to the patient's face. It may, however, be necessary to add very small quantities due to the fact that some nitrous oxide escapes through the skin.

*n.* When patient is in the normal anesthesia plane, ether may be added. Care should be exercised and the ether added slowly and in small volumes so that the vapor does not escape due to the fact that it is possible to build up very high concentrations of ether quite rapidly.

**Caution: Danger!!!** Ether mixtures are explosive, so be extremely careful to avoid use in hazardous operating procedures involving electrical apparatus and proximity to open flame.

*o.* To add ether, turn control valve on ether vaporizer to desired position. The numbers on the dial indicate the fraction of the gases inhaled which are being exposed to ether. (See par. 10c.)

*p.* As soon as the patient is relaxed, an oral or nasal pharyngeal airway should be introduced. The shut-off valve on the face inhaler Y should be closed while the tube is being inserted to prevent loss of gas.

*q.* After the anesthesia is under way it will, no doubt, be necessary to increase the oxygen flow rate from time to time in order to maintain normal anesthesia.

*r.* To force oxygen into the patient's lungs—

- (1) Turn absorber control valve to "OFF."
- (2) Open oxygen flowmeter needle valve.
- (3) Set exhaling valve on absorber to "0."

*s.* Hyperventilation may be used if desired when the case is finished—

- (1) Empty rebreathing bag. (See par. 14k.)
- (2) Turn absorber control to "OFF."
- (3) Increase oxygen flow rate.
- (4) Exhaling valve on absorber should be set at "0" so patient can exhale freely.

*t.* At the end of the operation close the cylinder valves and flowmeter needle valves, and detach the tubing and inhaler from the apparatus for cleaning.



## PART TWO — B

### OPERATING INSTRUCTIONS (HEIDBRINK)

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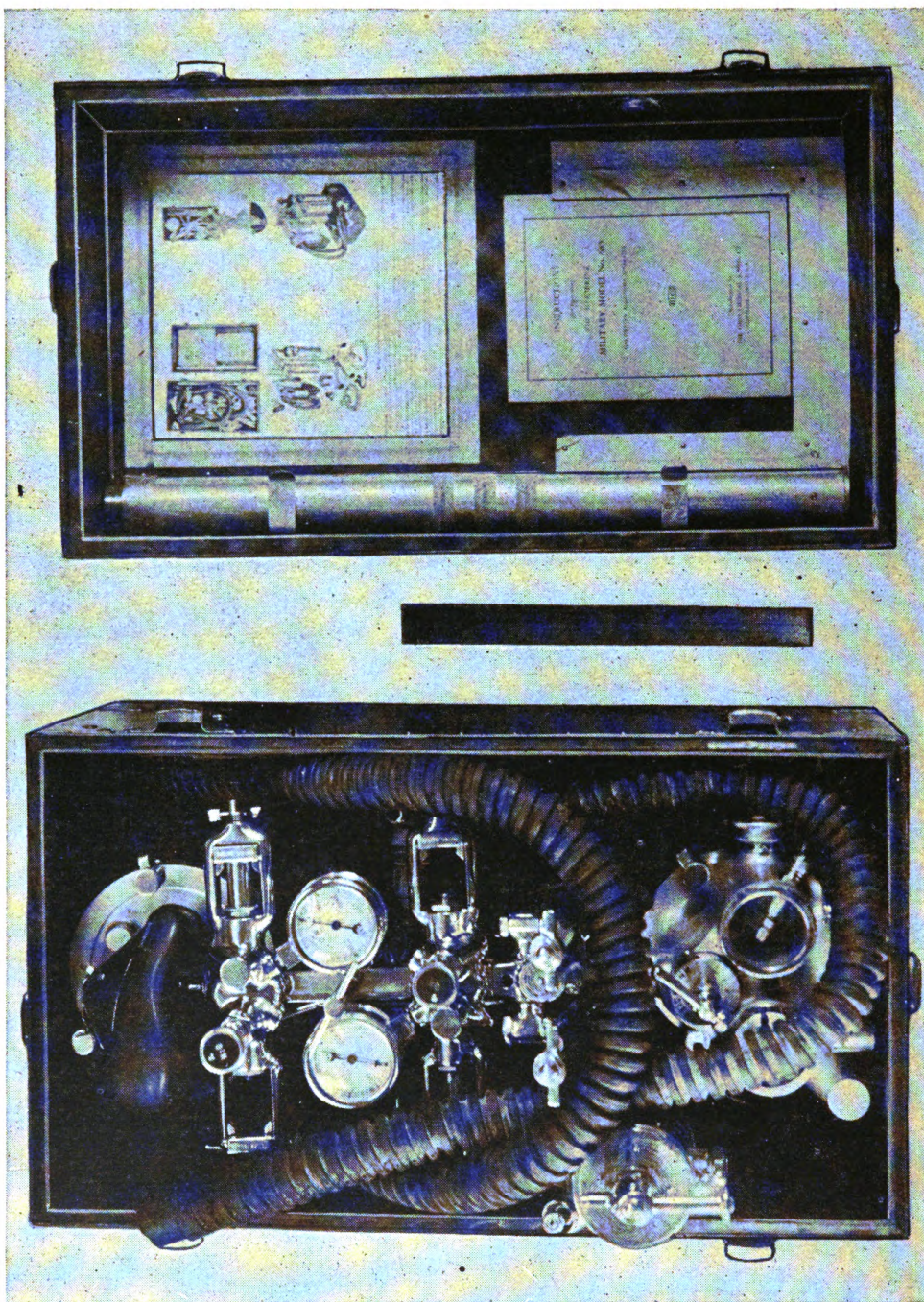
#### Section VII. GENERAL

##### 15. Scope

Part Two—B contains information for the guidance of the personnel responsible for the operation of the Heidbrink military model No. 685 portable anesthesia apparatus with the description and location of the controls and instruments.

##### 16. New Equipment

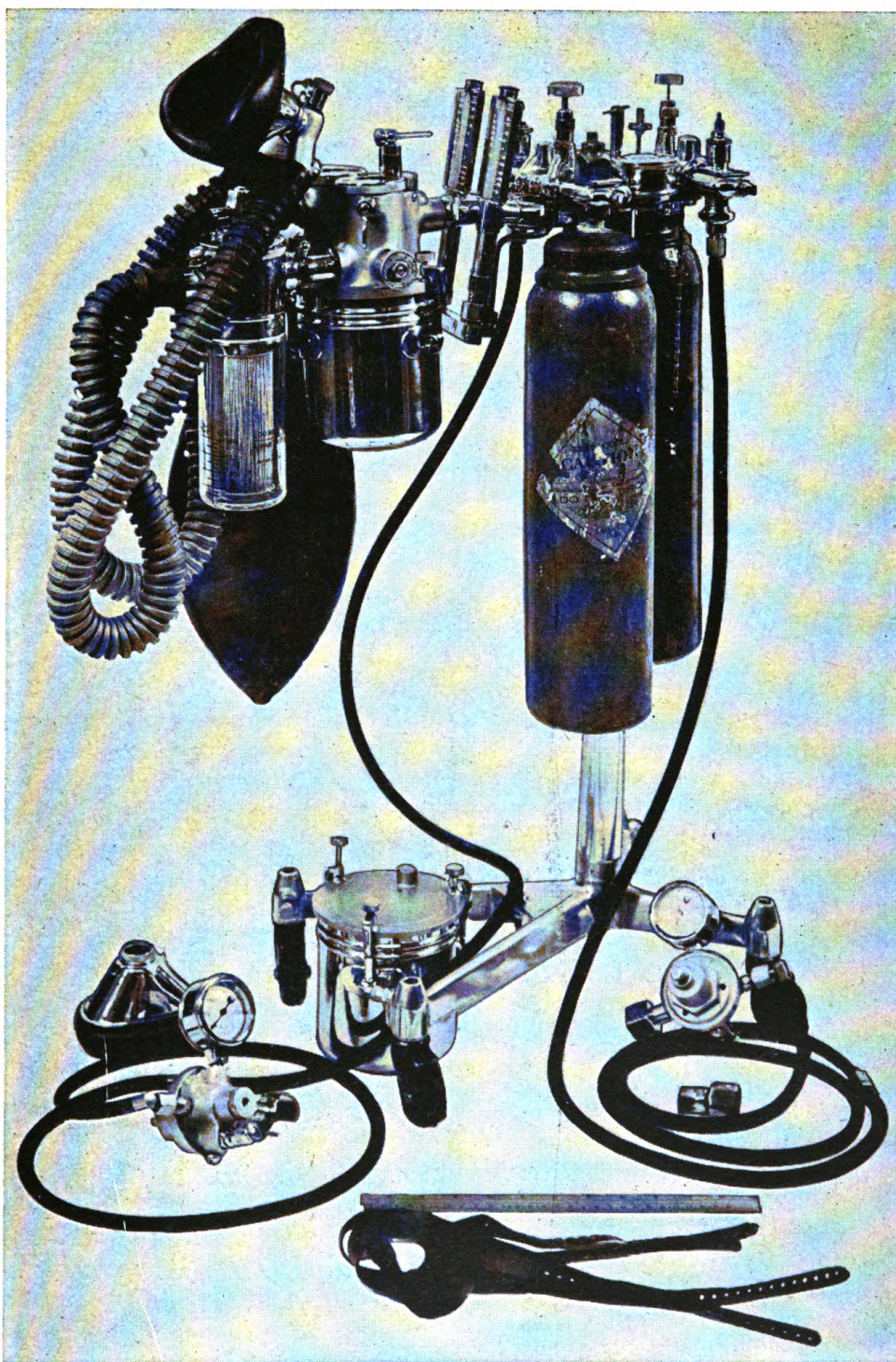
- a. UNCRATING. (1) Open shipping box carefully.
- (2) Remove paper packing to uncover case.
- (3) Lift the case carefully from the shipping box.
- b. UNPACKING FROM CARRYING CASE AND ASSEMBLING. (1) Release the lid hooks and remove the lid of the carrying case.
- (2) Remove all loose parts such as masks, corrugated rubber tubing with face inhaler Y attached, head strap, and high-pressure tubing.
- (3) Unscrew T handle head holding screw and remove the head assembly.
- (4) Remove ether jar, regulator, and extra soda lime canister.
- (5) When apparatus is to be used outside of case—
  - (a) Unscrew wing nut in base casting and remove base casting.
  - (b) Pull the caster locks outward.
  - (c) Remove the casters, invert them, and place in the base casting.
- (6) Unscrew head section upright by lifting up on locking ring and turning head section upright counterclockwise.
- (7) Screw base section upright into the base casting. The upright is found in the upper part of the carrying case. Be sure that locking ring fits into groove in the base.
- (8) Screw head section upright on top of base section upright. Be sure that locking ring fits into the groove in the base section upright.
- (9) Place head assembly on head section upright. Be sure the slots in the head assembly fit into grooves in head section upright.
- (10) Attach ether vaporizer to exhalation side. No gasket is needed at this connection.
- (11) Attach rubber parts to the apparatus. (See fig. 4.)
- (12) In connecting cylinders to the apparatus it is important that the cylinders are connected to their proper yokes, that is, the oxygen cylinder to the oxygen yoke and the nitrous oxide cylinder to the nitrous oxide yoke. See AR 850-60 for further information on gas cylinders.



*Figure 3. Portable anesthesia apparatus, Heidbrink military model No. 685, packed in carrying case.*

- (13) If small cylinders are used—
- (a) Remove any protective tape from the cylinder valve and open the valve to blow out any dirt particles in the valve aperture.
  - (b) Remove all old washers in the yoke. If this is not done, the yoke may be damaged and the yoke stabilizer may be broken by bringing the great force on the cylinder in an effort to prevent a leak.





*Figure 4. Portable anesthesia apparatus, Heidbrink military model No. 685, assembled.*

(c) Place a new small fiber washer (9R03134) in the small cylinder yoke. Use one washer only, making sure it is a small fiber washer.

(d) Place cylinder in yoke and tighten in place.

(e) If one cylinder of each gas is used, keep empty intercommunicating yoke plugged tightly with yoke plug. A small fiber washer is used with the yoke plug.

(f) If two cylinders of the same gas are used in the intercommunicating yokes, open only one at a time.

(14) If large cylinders are used—

(a) Open the valve to blow out dirt particles that may be in the valve aperture. At this time note whether the cylinder valve outlet is commercial or medical. The large medical oxygen cylinder valve outlet is a  $\frac{1}{2}$ -inch threaded fitting having a flat facing with two concentric indentations. The oxygen regulator provided with this apparatus will fit directly to this after a large fiber washer (9R03136) has been put in place between the regulator and cylinder. However, in order to apply the oxygen regulator to a commercial oxygen cylinder which has a  $\frac{7}{8}$ -inch threaded outlet with a cupped face, a high-pressure cylinder valve adapter (7789000) is necessary. No washer is placed at the cylinder-adapter union since it is a ground metal-to-metal connection. However, a large fiber washer must be placed at the union of the regulator and adapter.

(b) Attach high-pressure tubing to the side of the regulator using the right angle connection. The high-pressure tubing is color coded according to the gas with which it is used. The ferrule at each end of the tubing is either green for oxygen or blue for nitrous oxide.

(c) Attach the nitrous oxide regulator to the large nitrous oxide cylinder, using a large fiber washer at this union. Blow debris out of cylinder valve before attaching. All nitrous oxide large cylinder valve outlets are the same.

(d) Check small cylinder yoke screen for dirt particles or enlarged perforations and clean or replace if necessary. (See par. 69b.)

(e) Attach nitrous oxide high-pressure tubing using right-angle connections.

(f) The other end of the high-pressure tubing, which is attached to the shut-off valve, is then placed in position in its proper small cylinder yoke on the machine head. Use the same precautions in placing the shut-off valve in the yoke that are used with a small cylinder. (See par. 16b (13).)

(g) Always make sure that large cylinders are properly secured against falling if used in the upright position.

(15) If a large cylinder is being used and there is a small cylinder in the yoke opposite the regulator tubing shut-off valve, great care must be exercised to turn the regulator tubing shut-off valve completely off before opening the small cylinder valve. If this caution is not observed and for some reason the check valve in the intercommunicating yoke does not seat properly, the gas from the cylinder will travel through the large tank regulator tubing and may result in damage to the regulator and injury to personnel.



*c.* **DISASSEMBLING AND PACKING IN CARRYING CASE.** (1) Remove small cylinders. If large cylinders were in use, remove regulators and place regulator in proper compartment of the carrying case. It is not necessary to remove the high-pressure tubing from the regulator or shut-off valves from the yokes when repacking.

- (2) Remove all rubber parts.
- (3) Remove ether vaporizer.
- (4) Remove head assembly by unscrewing T handle head holding screw.
- (5) Remove head section upright from base section upright.
- (6) Unscrew base section upright from the base casting.
- (7) Place head section upright on base casting.
- (8) Pull outward on caster locks and remove and reverse casters.
- (9) Repack the case carefully. (See fig. 3.) The extra soda lime canister must be replaced before the head assembly.
- (10) Screw down on wing screw in base casting.
- (11) Screw T handle on tightly after replacing head assembly.
- (12) Replace accessories and rubber parts.
- (13) Lock carrying case.

## **17. Used Equipment**

The procedure for new equipment applies also to used equipment. (See par. 16.)

## **Section VIII. CONTROLS AND INSTRUMENTS**

### **18. Controls**

*a.* **FLOWMETER NEEDLE VALVE (OXYGEN AND NITROUS OXIDE).** The flowmeter needle valve regulates the flow of gas through the apparatus.

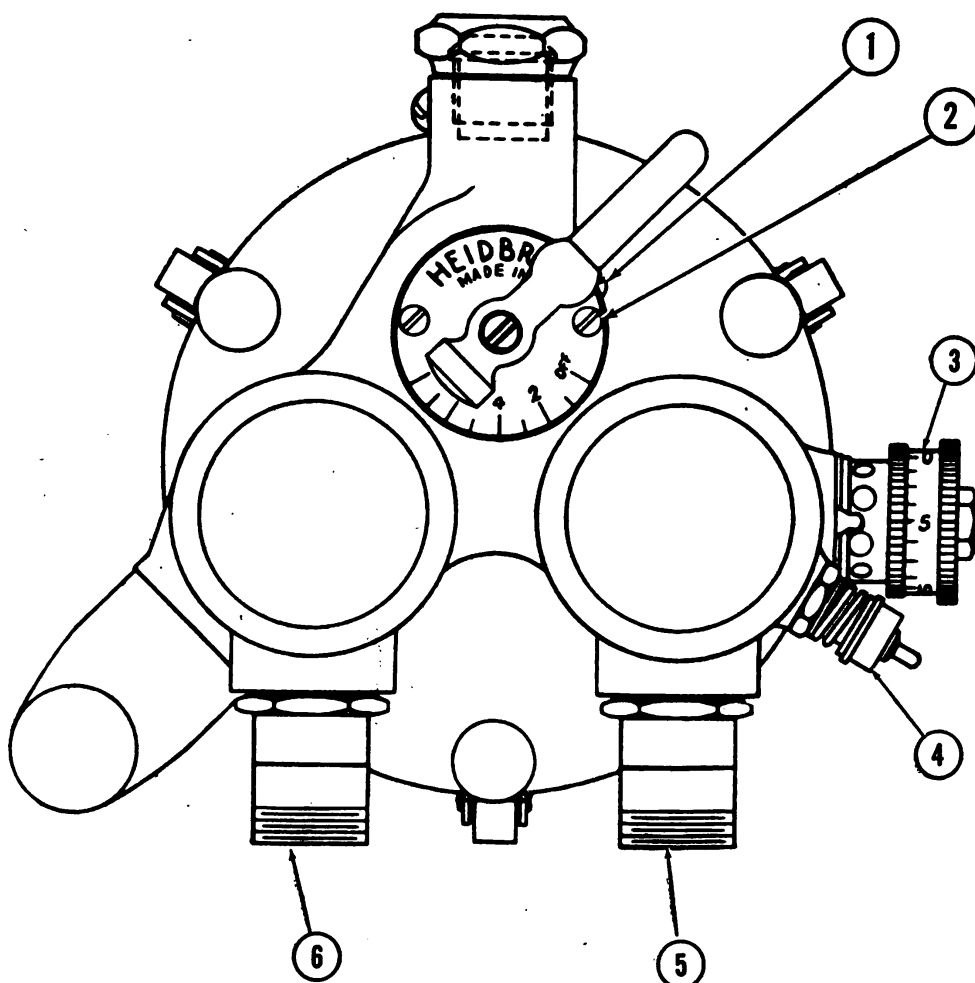
*b.* **ABSORBER CONTROL HANDLE.** The absorber control handle regulates the proportion of the exhaled gases which pass through the soda lime to the rebreathing bag.

*c.* **ETHER VAPORIZING CONTROL HANDLE.** The ether vaporizer control handle regulates the amount of gases being breathed which go through the vaporizer.

*d.* **REGULATOR ADJUSTING SCREW.** The regulator adjusting screw regulates the pressure from the regulator to the high-pressure tubing. The regulators reduce the pressure coming from the gas cylinder to a pressure of about 50 pounds per square inch.

*e.* **FACE INHALER Y COMBINATION AIR AND SHUT-OFF VALVE.** The face inhaler Y combination air and shut-off valve controls the passage of gas between the breathing tubes and face mask. When the knurled knob is IN the patient breathes to and from the atmosphere through the valve apertures. When the knurled knob is OUT the patient breathes into the apparatus.

*f.* **FACE INHALER Y EXPIRATORY VALVE.** The face inhaler Y ex-



<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>	<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>
1. SR00989	Screw, 8-32 x $\frac{5}{16}$ Inch R.H.M., 144 to Pkg.	4.	Lung Inflation Valve
2. SR00914	Screw, 8-32 x $\frac{5}{16}$ Inch, Fil H. M., 144 to Pkg.	5.	Exhalation Port
3.	Pressure Limiting Valve	6.	Inhalation Port

*Figure 5. Absorber, top view, Heidbrink.*

piratory valve when turned counterclockwise permits the patient to exhale through the valve into the atmosphere.

g. **LUNG INFLATION VALVE HANDLE.** The lung inflation valve handle is located on the expiratory valve housing. When in the "UP" position it prevents the exhalation valve from opening, thereby building up a pressure in the apparatus, which may be used for lung inflation. In the "DOWN" position it has no effect on the apparatus.

h. **PRESSURE LIMITING VALVE DIAL.** The pressure limiting valve dial provides a means of limiting the pressure in the apparatus to any desired pressure from 0 to 20 mm of mercury. Any pressure in excess of the pressure set on the dial will bleed out through the pressure limiting valve.

i. **CYLINDER VALVE.** The cylinder valve opens or closes the gas cylinder.

j. **HIGH-PRESSURE TUBING SHUT-OFF VALVE.** The high-pressure tubing shut-off valve controls the flow of gas from the regulator tubing into the operating head.

## 19. Instruments

a. **HIGH-PRESSURE GAUGE (OXYGEN AND NITROUS OXIDE).** The high-pressure gauge indicates pressure in the gas cylinder. When a large cylinder is used with this apparatus, the pressure in the cylinder will show the high-pressure gauge on the regulator. The high-pressure gauge on the apparatus head will not register when the large cylinder is used. This gauge will register when the small cylinders are being used.

b. **ETHER VAPORIZER DIAL.** The ether vaporizer dial indicates the fraction of expired gases passing through the ether vaporizer. When in the "SHUT" position none of the expired gases pass through the vaporizer.

c. **FLOWMETER (OXYGEN AND NITROUS OXIDE).** The flowmeter indicates the amount of gas in liters per minute or gallons per hour that is being delivered to the patient from the cylinder.

d. **ABSORBER CONTROL DIAL.** The absorber control dial indicates the fraction of gas passing through the soda lime. When in the "OFF" position no exhaled gases pass through the soda lime. When in the "FULL ON" position all of the exhaled gases pass through the soda lime for maximum carbon dioxide absorption. At the "4" position, half of the gases will pass through the soda lime, and the other half by-pass the soda lime and go directly to the re-breathing bag.

e. **PRESSURE-LIMITING VALVE DIAL.** The pressure-limiting-valve dial on the expirator side of the absorber indicates the pressure in the apparatus in millimeters of mercury.

## Section IX. OPERATION UNDER USUAL CONDITIONS

### 20. General

The technique of operating the anesthesia apparatus, portable is left to the discretion of the medical officer in charge. However, the technique outlined in paragraph 22 is recommended by the manufacturer of this equipment. It is offered as a guide only.

### 21. Preparation for Operation

a. **FILL SODA LIME CANISTER.** (1) Loosen the three knurled screws holding the canister cover by turning counterclockwise.

(2) Swing the three levers back to release the canister.

(3) Fill the canister to the top with 4-8 mesh soda lime. Do not use a finer mesh as it increases resistance to the breathing circuit.

(4) Replace canister by swinging the three levers back into place and tightening the three knurled screws. Be sure that upright tube in canister fits into the down tube in absorber head.



b. CHECK SODA LIME IN CANISTER. It is suggested that before operating a unit which has already been set up, the soda lime in the canister be inspected to make sure that it is not caked or excessively moist. The efficiency of excessively moist soda lime may be restored by heating for a few minutes to drive out the excess moisture. The life of soda lime varies from 1 to 8 hours of usage and should be replaced at the end of that time.

c. FILL ETHER VAPORIZER. (1) Remove funnel plug and fill to a desired level, but do not fill above the line marked "Do not fill above this line."

(2) Replace the funnel plug. Be sure gasket is in place.

## 22. Operation

- a. Close both flowmeter needle valves.
- b. Open one nitrous oxide and one oxygen cylinder valve two or three complete turns.
- c. Place headstrap under patient's head and neck.
- d. Close the face inhaler Y exhaling valve.
- e. Close the shut-off valve of the face inhaler Y. (See par 18e.)
- f. Set the absorber control at the "OFF" position.
- g. Open the nitrous oxide flowmeter needle valve until the bag is three-quarters full, then close the valve. When shutting flowmeter needle valves off, turn down on needle valve gently only until the flowmeter indicating rod settles to the bottom of the scale. It is not necessary to turn flowmeter needle valve down tightly. The latter practice causes excessive wear on the needle valve seat.
- h. Place the face mask lightly over the patient's nose and mouth.
- i. Open the combination air and shut-off valve in the face inhaler Y, and adjust the oxygen flowmeter needle valve so that the flowmeter indicates 200 cc per minute.
- j. After 1 to 2 minutes it is desirable to empty the bag which may contain considerable nitrogen, which the patient eliminates as the anesthetic is absorbed.

(1) Open the expiratory valve of the face inhaler Y.

(2) Raise lung inflation valve handle on the right side of the absorber housing to the "UP" position, marked, "Up when inflating lungs." The patient will now inhale from the bag and exhale into the open through the expiratory valve, thus emptying the bag. *It is imperative that the expiratory valve be opened first as raising the lever shuts off the exhaling tube which makes it impossible for the patient to exhale unless the expiratory valve is open.*

(3) Never empty the bag by lifting the face inhaler and pressing the bag against the knee.

(4) As soon as the bag is practically empty, promptly return the lung inflation valve lever to the "DOWN" position.

(5) Close the expiratory valve on the face inhaler Y.

(6) Open the nitrous oxide flowmeter needle valve enough to fill the bag to a slight distention.

k. All nitrous oxide flow may now be discontinued as long as the

inhaler is snugly held against the patient's face and the bag remains slightly distended.

*l.* Up until this time it is seldom necessary to change the oxygen flow from its setting of 200 cc per minute. The oxygen flow is now usually raised to 250 cc per minute. Thereafter the oxygen flow is increased or decreased according to the symptoms. Ordinarily oxygen changes should be made gradually because with the closed system no oxygen is wasted and too much oxygen is apt to cause the patient to awaken.

*m.* It may at times be necessary quickly to introduce additional oxygen to lighten anesthesia promptly and restore the patient to proper breathing. If in doing this, considerable oxygen is flushed into the bag, it will be necessary to empty the bag again and fill it. (See par. 22*h*.) The necessity for high-flow oxygen usually indicates that thereafter the oxygen flow for metabolic needs should be increased.

*n.* The ether vaporizer should now be gradually opened. Set the pointer of the valve handle at number "2," after a few breaths move it up to number "3," etc., until number "5" is reached. Leave it there until complete relaxation is obtained. As soon as the patient tolerates the ether without coughing or holding the breath, the absorber should be opened to "Full Open" position. Should there be any shallow breathing, temporarily close the absorber until good respiration is restored. When this has been accomplished, reopen the absorber to the extent necessary to maintain satisfactory respiration.

*o.* As soon as relaxation is obtained, the ether should be immediately discontinued. Most of the ether remains in the closed circuit and practically none is wasted; therefore, care should be taken not to oversaturate the patient. It is sometimes necessary to reopen the ether vaporizer for short intervals to maintain relaxation.

*p.* After the patient is relaxed, it is well to insert a nasal or oral pharyngeal airway. Before removing the inhaler for this purpose, close the face inhaler Y shut-off valve to save the gas in the bag. Insert the airway, replace the face inhaler Y, and open the face inhaler Y combination air and shut-off valve promptly. Delay in this procedure will permit the rebreathing bag to become over-distended. If this occurs, temporarily open the exhaling valve on the face inhaler Y one-fourth to one-half turn.

*q.* The anesthetist should always observe that the chin is well forward. If the straps have a tendency to pull it backward, readjust the straps or apply forward pressure on the chin with the fingers to correct the difficulty. Adjust the upper straps to exert the greater tension. The lower straps should be just tight enough to produce leakproof contact between inhaler and chin.

*r.* At the end of the operation close the cylinder valves and flow-meter needle valves, and detach the tubing and inhaler from the apparatus for cleaning.

## PART THREE—A

### MAINTENANCE INSTRUCTIONS (McKESSON)

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#### Section X. GENERAL

##### 23. Scope

Part Three—A contains information for the guidance of the personnel of the using organizations responsible for the maintenance (first and second echelon) of the portable anesthesia apparatus, McKesson model No. 675. It contains information needed for the performance of maintenance services.

#### Section XI. SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

##### 24. General

There are no special organizational tools or equipment.

#### Section XII. LUBRICATION

##### 25. Lubrication

The portable anesthesia apparatus needs no lubrication. **Caution:** Never grease or oil any part of the apparatus because both oxygen and nitrous oxide support combustion and the grease or oil may be ignited by the heat generated on opening the high-pressure cylinder.

#### Section XIII. PREVENTIVE MAINTENANCE

##### 26. General Information

Preventive maintenance services as prescribed by Army Regulations are a function of using echelons of maintenance.

##### 27. Before Operation Services

- a. Check the soda lime canister on the apparatus for soda lime. If soda lime is found to be caked or excessively moist, remove and replace with fresh soda lime. (See par. 13a.)
- b. Check to be sure extra soda lime canister is available and is filled with fresh soda lime.
- c. Check *all* cylinders for proper gas content, and ease in opening and closing valve.
- d. If the humidity is low, rinse breathing tubes and rebreathing bag with water, drain, and replace while moist.

## 28. After Operation Services

- a. All rubber parts must be washed. (See par. 37.)
- b. Hang breathing tubes up straight and keep all rubber goods in a cool dark place.
- c. Never store apparatus near a radiator as this will damage rubber parts.
- d. Remove ether from the apparatus at the end of the day's schedule. Ether may be left in the apparatus for a short time between operations, but the ether vaporizer must be completely shut off.
- e. At the end of each operating day during which ether was used, rinse ether wick and jar with water and allow to dry.
- f. If the apparatus is used infrequently, remove soda lime and store in a closed container.
- g. Do not cover gas machine or gas cylinders with any fabric because removal of the material may cause a spark which could ignite any ether vapor which might be near the apparatus.

## 29. Monthly Operation Services

Once a month, or periodically as often as it is found necessary under local conditions, all unions should be checked and tightened where necessary to prevent loss of gas. (See par. 39.)

## Section XIV. TROUBLE SHOOTING

### 30. Valve or Moving Part Becomes Sticky or Does Not Operate Smoothly

- | <i>Possible causes</i>     | <i>Possible remedies</i>  |
|----------------------------|---|
| a. Dirt in part of valve.  | Clean with carbon tetrachloride or scrape clean. (See par. 38.) |
| b. Binding of moving part. | Realign or replace part.  |

### 31. Leak in Apparatus

- | <i>Possible causes</i>           | <i>Possible remedies</i>                      |
|----------------------------------|---|
| a. Leak in high-pressure system. | Find and repair leak. (See par. 39c and 39d.) |
| b. Leak in breathing system.     | Find and repair leak. (See par. 39b.)         |

### 32. Flowmeter Does Not Drop to "0" Position When Needle Valve is Shut-Off

- | <i>Possible causes</i>       | <i>Possible remedies</i>        |
|------------------------------|---------------------------------|
| a. Dirt in flowmeter.        | Clean flowmeter. (See par. 41.) |
| b. Faulty needle valve stem. | Replace stem. (See par. 40.)    |

### 33. Squealing Noise Comes From Regulator

- | <i>Possible causes</i>                     | <i>Possible remedies</i>                  |
|--|---|
| Spring under regulator bell cap vibrating. | Remove and invert spring. (See par. 44a.) |



### 34. High-Pressure Gauge Does Not Return to "0" When Gas is Off

#### *Possible causes*

#### *Possible remedies*

- a. Indicator hand set incor- Remove and replace in correct  
rectly on stem. position. (See par. 44c.)
- b. Cylinder shut-off valve leak- Replace cylinder if leak is severe.  
ing in the closed position.

### 35. Safety Valve on Regulator Pops Off

#### *Possible causes*

#### *Possible remedies*

- a. Leak in regulator seat. Replace regulator seat. (See par.  
44e.)
- b. Seat in safety valve not seal- Replace safety valve.  
ing.
- c. Spring in safety valve fa- Replace safety valve.  
tigated.
- d. Safety valve adjusting screw Readjust safety valve adjusting  
out of adjustment. screw. (See par. 44g.)
- e. Regulator adjusting screw Readjust adjusting screw. (See  
screwed down too far. par. 44e (15).)

### 36. Needle Valves Do Not Shut Off Flow of Gas to Flowmeter

#### *Possible causes*

#### *Possible remedies*

- a. Defective needle valve stem. Replace needle valve stem. (See  
par. 40b.)
- b. Foreign particles in valve Remove particles and replace  
seat. stem if scored. (See par. 40b.)
- c. Needle valve seat or stem Replace needle valve assembly or  
scored. needle valve stem. (See par.  
40.)

## Section XV. MAINTENANCE OPERATIONS

### 37. To Sterilize Rubber Parts

To sterilize rubber parts of the apparatus after use, wash in soap and water, rinse thoroughly, dry and sterilize by dipping in an aqueous sterilizing solution, and hang up to drain. *Never autoclave any rubber parts.*

### 38. To Clean Apparatus

- a. Soda lime deposits may be removed with a brush.
- b. Rubber parts may be washed in soap and water, but should be thoroughly rinsed and dried as soap deteriorates rubber.
- c. The ether jar and wick are rinsed out with water and allowed to dry.
- d. Any sticky valve or moving part which does not work easily should be scraped clean or cleaned with carbon tetrachloride. Never oil or grease any of the parts of the apparatus. Be sure that the hands are not greasy because even a slight film of oil in the

high-pressure gas system may be ignited by the heat generated on opening the high-pressure cylinder. Since oxygen and nitrous oxide support combustion, a fire and explosion hazard would be created.

*e.* Any part that becomes dirty may be cleaned with carbon tetrachloride.

### 39. To Find and Repair Leaks in Apparatus

*a.* GENERAL. A leak in the high-pressure system or breathing system is the most common trouble with the apparatus. It is suggested that a solution of soapsuds be applied with a brush to any part where a leak is suspected. Leaks are indicated by the appearance of bubbles. Remove soapsuds to prevent stickiness or deterioration of rubber parts. A slow leak may not cause bubbles for a minute or two. Leaks at gasket or washers may be stopped by tightening the connection or packing nut or replacement of washer or gasket.

*b.* TO CHECK FOR LEAKS IN BREATHING SYSTEM. (1) Continual loss of pressure from the rebreathing bag during anesthesia indicates that pressure is being lost between the flowmeter needle valve and the face inhaler Y.

(2) To locate the leak, turn the face inhaler Y shut-off valve off, closing off the breathing tubes.

(3) Fill the entire breathing system with gas.

(4) Exert pressure on the rebreathing bag and test the following points for leaks:

(a) Flowmeter tube gasket, both at the top and bottom of the flowmeter glass tube.

(b) Test absorber to operating head connection. Be sure that there is a gasket at this union.

(c) Check all connections on the absorber, including around the check valve inspection windows.

(d) Test absorber bag assembly holder connection.

(e) Test rebreathing bag and rebreathing bag connection.

(f) Check inhaler tubing connections to ether jar and absorber.

(g) Check ether vaporizer connection to absorber.

(h) Check both ends of supply tube which connects the flowmeter needle valve and the flowmeter.

(i) Check face inhaler Y shut-off valve in the open position. Test the front facing of this valve by holding the hand over the face mask outlet connection and putting soap suds over the ports in front of the face inhaler Y. If bubbles develop, the front facing of this valve is deficient. The valve is in this position during anesthesia and, therefore, should be checked in this manner.

(5) Test expiratory and inspiratory valves for leakage.

(a) Disconnect the face inhaler Y from inhaler tubing.

(b) Breathe in and out of the inspiratory valve. If the inspiratory valve does not leak it will be possible to breathe from the apparatus, but not into it.

(c) Breathe in and out of the expiratory valve. If the expiratory valve does not leak it will be possible to breathe into the apparatus, but not from it.

c. TO CHECK FOR LEAKS IN HIGH-PRESSURE SYSTEM WHEN USING SMALL CYLINDERS. (1) Close the flowmeter needle valve of the gas selected and then open the small cylinder valve. Check to see that the flowmeter needle valve is not leaking by noting if the flowmeter stays at "0."

(2) Turn the small cylinder valve off, and if the needle in the high-pressure gauge begins to drop, a high-pressure leak is indicated.

(3) Open the small cylinder valve again and test the outlet of the flowmeter head with soapsuds to make sure that the leak is not through the needle valve even though it is in the off position. It will be necessary to remove the absorber assembly.

(4) Check with soapsuds the union of the cylinder to the yoke, particularly around the small cylinder yoke gasket.

(5) Check the union nut making sure the union is tight and the gasket is in place.

(6) Make certain the yoke plug is in place and tight on the intercommunicating yoke, and also that the union nut on that side is tight. There should be a large fiber washer at both unions.

(7) Check with soapsuds around the high-pressure gauge.

(8) Close the cylinder valve and check around the cylinder valve stem for a leak in the packing.

(9) Tighten any leaky unions and replace gaskets if necessary.

(10) If a leak at a union of the small cylinder and small cylinder yoke persists—

(a) Remove cylinder.

(b) Remove all of the washers.

(c) Examine the face of the cylinder valve to be sure there are no deep scratches in the valve where it contacts the washer.

(d) Examine the concentric rings around the cylinder valve outlet to be sure the washer particles have not been compressed into it.

(e) Examine the yoke plunger to be sure that washer particles have not been compressed into the concentric rings. Do not scratch the face of this plunger. If it is difficult to clean this channel, unscrew the hexagon nut that holds the yoke, tilt the yoke upward, and force the plunger down through the yoke. Soak the plunger in hot water until the washer particles may be easily removed with a pointed instrument.

(f) If the plunger will not come out of the yoke, remove the yoke from the machine (par. 46) and put it in water with the plunger. In such a case examine the yoke. It probably has been abused to such an extent that the sides have been stretched and sway inward. If so, the entire yoke has been strained so badly the yoke casing is pinching in on the plunger. Replace with new yoke and plunger.

(11) Check for leaks in the yoke check valve.

(a) If the pressure in the cylinder in the opposite yoke is below 500 pounds there may be a slight leakage which is unavoidable because of the construction of the check valve. Such leakage will not be consequential while replacing a cylinder. At other times all yokes should be occupied by a cylinder or yoke plug.

(b) In testing remove cylinder from one hanger yoke and open a cylinder containing over 500 pounds pressure in the opposite communicating yoke.

(c) Apply soapsuds over the outlet of the yoke plunger in the empty yoke. If bubbles indicate a rapid leak, replace the yoke plunger or check valve. (See par. 46.)

(d) Test each yoke separately.

d. TO TEST FOR LEAKS IN HIGH-PRESSURE SYSTEM WHEN USING LARGE CYLINDERS. (1) Close the flowmeter needle valve of the gas selected, open the regulator tubing shut-off, and then open the cylinder valve. Check to see that the needle valve is not leaking by noting if the flowmeter stays at "0."

(2) Close the cylinder valve, and if the needle of the high-pressure gauge on the regulator starts to drop, a high-pressure leak is indicated. The leak will be located somewhere from the cylinder valve packing down to, and including the flowmeter needle valve stem seat.

(3) Check the cylinder valve packing with soapsuds. If there is a leak at this point, tighten the hex packing gland nut directly beneath the cylinder valve handwheel.

(4) Open the cylinder valve and test at the union of the regulator and cylinder valve, at safety pop-off valve, and at the high-pressure gauge union with the casting.

(5) Test the holes in the bell cap of the regulator. Bubbles forming at the holes of the bell of the regulator indicate that the regulator diaphragm is perforated. Do not attempt to solder this diaphragm as it needs a special type of tempering. Replace with new regulator. Test hex union of the regulator tubing to the regulator, making sure that there is a washer at this union.

(6) Test the connections at both ends of the regulator tubing. Check aperture in the regulator tubing shut-off valve for a valve stem seat leak.

(7) Test along the seam of the lower part of the regulator, that is, opposite the regulator bell. A removable section screws into the regulator body and a seam will be noticed where these parts go together. If this seam leaks, use a wrench on the large hexagon part and remove this part. Clean shellac from threads, apply new shellac, and replace.

(8) Tighten all loose unions and replace deficient gaskets as indicated above.



#### 40. To Repair Needle Valve

a. **REPLACEMENT OF NEEDLE VALVE ASSEMBLY.** (1) Disconnect the copper tube connection and needle valve.

(2) Unscrew needle valve assembly from head of the unit.

(3) Replace with new valve, first applying a litharge and glycerine mixture to the upper threads and then tighten securely. Make sure litharge and glycerine mixture does not run down onto the opening beneath the needle valve stem.

*Note.* When installing parts such as gauges, safety valves, or similar parts which are not ground connections or do not use a washer or gasket to make them gas tight, a luting compound of litharge and glycerin may be used. This compound dries in a short time into a hard cement. It is made by placing a small amount of litharge in a container and adding glycerin until a thick paste is formed. The advantage of a thick paste being that it dries quicker and speeds up repair. Place the litharge and glycerin on the first three or four threads of the part and thread into the opening by hand three or four turns. Rotate the part back and forth several times to be certain that the litharge and glycerin has penetrated the threads thoroughly. The litharge and glycerin should set for at least 30 minutes before retesting the equipment. When tightening the part, do not use too much pressure, only enough so that the part is firmly in place. If it is screwed in too tightly, it will be impossible to remove. In removing the part it is necessary to tap the base lightly all the way around with a ball peen hammer. This will crack the cement and permit removal of the part.

**Caution.** Under no circumstances should conventional luting compounds be employed in place of the litharge and glycerine. These are highly combustible in contact with pure oxygen and are very likely to produce spontaneous combustion. Mixtures containing white lead, linseed oil, etc., are prohibited.

b. **NEEDLE VALVE STEM REPLACEMENT.** (1) Remove valve stem by turning counterclockwise until the stem is free. Do not pull the stem through the packing but unscrew it.

(2) Replace the stem by turning it clockwise. Do not push through the packing.

c. **NEEDLE VALVE PACKING REPLACEMENT.** (1) Remove needle valve stem.

(2) Remove hex nut which exposes packing.

(3) Remove old packing and replace with new needle valve packing washer.

(4) Replace hex nut and needle valve.

#### 41. To Repair Flowmeter

a. **FLOWMETER FLOAT STICKS.** (1) Open the needle valve until the float goes to the top and then turn off again. This may correct the trouble.

(2) If the float still sticks—

(a) Remove metal supply tubing from base of flowmeter.

(b) Remove the large hex nut at the base of the flowmeter permitting the float assembly to drop.

(3) Lift the float carefully off the nozzle, being careful not to bend the float. Should the float be damaged replace with a new one. Oxygen and nitrous oxide floats are not interchangeable.

(4) Dip a cotton tipped applicator in ether and swab out the inside of the float, being careful not to get any ether on the outside of the float. Under no circumstances try to clean the nozzle with a metallic instrument.

(5) Replace float on top of the nozzle, and replace float assembly.

(6) Connect metal supply tubing to base of flowmeter.

**b. REPLACING BROKEN GLASS FLOWMETER TUBE.** (1) Remove the slotted flowvalve nut and gasket.

(2) Clean all dirt from all parts of the flowmeter.

(3) Place new glass tube into flowmeter through the opening in the top. Be sure the rubber gasket is at both the top and bottom.

(4) Replace slotted flowvalve nut.

#### **42. To Remove and Replace Ether Jar and Wick**

**a.** Unscrew jar by turning clockwise when looking from the top.

**b.** Remove wick by pulling down with a rotating motion.

**c.** Replace wick.

**d.** Replace jar by turning counterclockwise until tight. Be sure there is a gasket at this union. This gasket (usually cork) is in place in the top of the ether jar.

#### **43. To Repair Absorber**

**a. REMOVAL AND REPLACEMENT OF GLASS INSPECTION WINDOWS.**

(1) Unscrew threaded rim over the glass crystal using the spanner wrench which is furnished with the apparatus.

(2) Unscrew ether vaporizer where it connects to the head.

(3) Insert screw driver through opening in absorber head and push out the glass crystal.

(4) To remove the other glass crystal, remove the absorber head from the apparatus and push glass out with a heavy wire.

(5) To replace, place the glass crystal over open part. Be sure both rims of opening and glass are clean and a gasket is in place.

(6) Replace the metal rim and tighten with the spanner wrench.

**b. REPLACEMENT OF CHECK VALVE DISKS.** (1) Remove glass inspection window. (See par. 43a.)

(2) Remove screws in the center of the valve disk.

(3) Lift out disk.

(4) Replace with new or repaired disk. Be sure the disk is flat and that the surface upon which it rests is clean.

(5) Replace screw in the center of the valve disk.

(6) Replace glass inspection windows. (See par. 43a.)

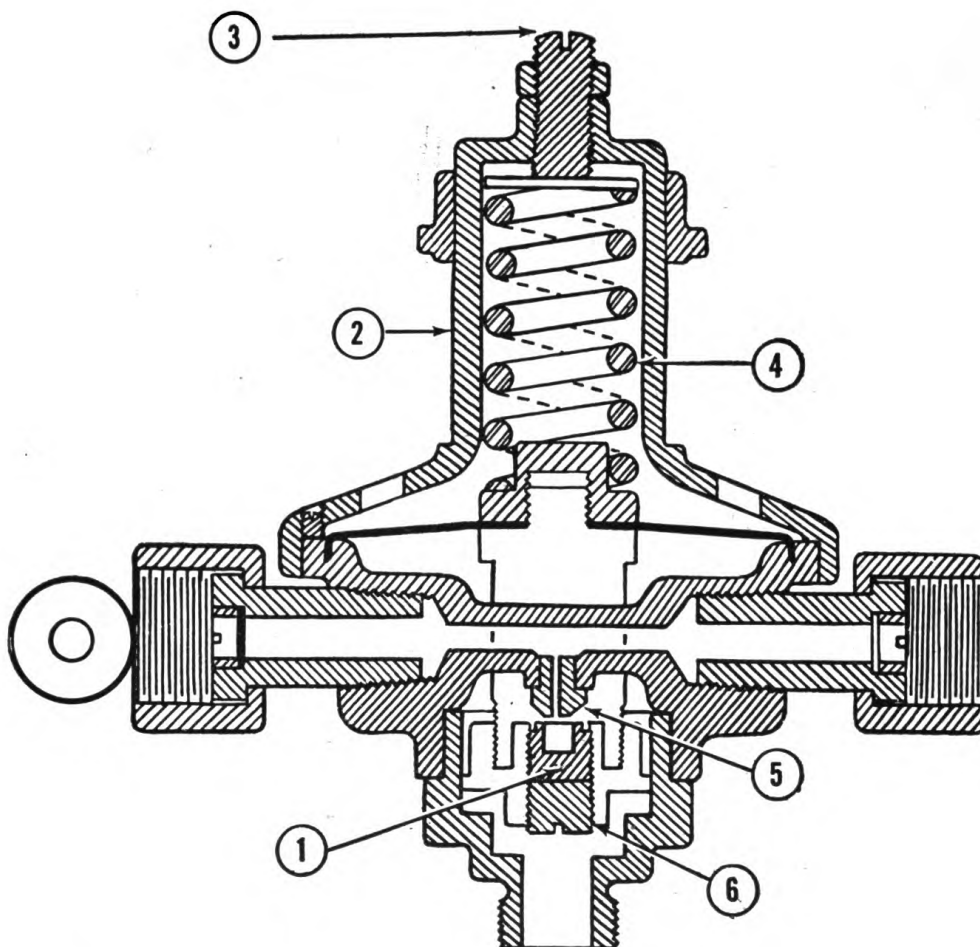
#### **44. To Repair Regulator**

**a. STOPPING SQUEALING NOISE IN REGULATOR.** (1) The squealing noise is caused by vibration of the spring in the regulator.

(2) Remove regulator bell by unscrewing it from the regulator.

(3) Turn the spring over.

(4) Replace regulator bell.



<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>
1. 9R02920	Seat, Regulator Valve
2. 9R03464	Bell, Regulator, Threaded
3. 9R03463	Screw, Adjusting, Diaphragm Spring

<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>
4. 9R03466	Spring, Regulator Diaphragm
5. 9R03470	Nozzle, Regulator
6. 9R03471	Lockscrew, Regulator Valve Seat

Figure 6. Regulator, McKesson.

b. GAUGE. (1) If defective, replace with a new one.

(2) Coat threads on new gauge with litharge and glycerin being careful not to get any in or on stud end and screw into place. (See note in par. 40a.)

c. ADJUSTING HIGH-PRESSURE GAUGE INDICATOR NEEDLE TO ZERO.

(1) Be sure that no pressure is in the line.

(2) Remove glass crystal from gauge by removing the two screws in the metal rim and pulling rim straight out, or unscrewing the metal rim counterclockwise depending upon the type of gauge.

(3) Remove indicator needle from the axle using two small screw drivers to force it off.

(4) Replace indicator needle on the shaft to register "0." Tap gently into place.

(5) Replace rim and crystal by pushing it straight down and

tightening the two holding screws, or screwing the rim on clockwise depending upon the type of gauge.

d. **SAFETY VALVE.** (1) Leakage generally indicates a defective regulator seat which first should be replaced with a new one. If this does not stop the leak, repair or replace safety valve.

(2) Loosen locking nut and screw out adjusting screw. Remove spring and valve seat.

(3) Clean off valve seat.

(4) Replace parts and adjust safety valve adjusting screw. (See par. 44g.)

e. **REMOVAL AND REPLACEMENT OF REGULAR SEAT.** (1) It is extremely important to proceed step-by-step exactly as follows:

(2) Start with the tank turned off. Loosen locking nut on top of regulator bell and turn the adjusting screw (fig. 6, part 3) counterclockwise six or eight times.

(3) Unscrew the hexagon nut on the end of the regulator tubing directly underneath the regulator. On removing this connection, see that there is a washer at this union.

(4) Unscrew the lock screw (fig. 6, part 6) from inside the regulator.

(5) Turn down the adjusting screw (fig. 6, part 3) about six turns after meeting resistance. This pushes the seat (fig. 6, part 1) away from the nozzle (fig. 6, part 5) and thus prevents further indentation of the seat.

(6) Remove the regulator valve seat. (See fig. 6, part 1.)

(7) Turn the adjusting screw (fig. 6, part 3) all the way up. This returns the seat carriage to the normal position.

(8) Stick the eraser of an ordinary pencil into the regulator and twist against the nozzle several times to clean the nozzle. (See fig. 6, part 5.)

(9) Open tank valve to blow out any particles remaining in the regulator.

(10) Screw repaired (par. 44f) or new regulator valve seat into the regulator with finger pressure only on the screw driver until the seat just touches the nozzle inside.

(11) Screw down on the adjusting screw (fig. 6, part 3) for six or eight turns after meeting resistance.

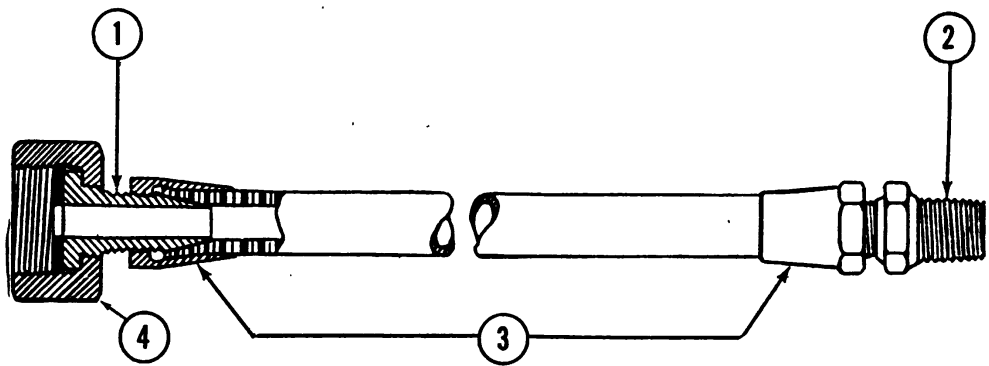
(12) Put screw driver back on the regulator valve seat and turn it to the right exactly one turn if a new seat is being inserted. If a repaired seat is being inserted, turn it to the right one and one-quarter turns. No resistance will be met this time as the seat is away from the nozzle.

(13) Again unscrew the adjusting screw. This brings the seat (fig. 6, part 1) firmly against the nozzle (fig. 6, part 5) so that in the next step the seat will not turn.

(14) Screw lock screw (fig. 6, part 6) in place against the regulator seat. This should be tight. Since the seat is against the nozzle, its position will not be disturbed by the lock screw.

(15) Readjust regulator to proper operating pressure.





Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 9R03484	Connection, Un on Nut, Regulator Tubing	3. 9R03481	Sleeve, Regulator Tubing
2. 9R03485	Connection, Regulator Tubing: For tank yoke adapter, lower case	4. 9R03483	Connection, Female, Hex Nut, Regulator Tubing

Figure 7. Regulator tubing connections, McKesson.

(a) With cylinder valve open, turn adjusting screw clockwise until safety valve begins to leak, then turn counterclockwise two turns.

(b) An alternate method is to open the flowmeter needle valves eight turns, and turn adjusting screw clockwise until the flowmeter registers at the top of the scale. Then turn adjusting screw clockwise two turns.

(16) Tighten locknut on top of regulator bell.

f. REPAIR OF REGULATOR SEAT. (1) Should there be no new seats available to replace a defective one, care should be taken in removing the defective seat as it will have to be re-used.

(2) A poor pressure holding seat may be refaced by gently but firmly rubbing the composition facing against emery cloth. Care should be taken in rubbing the facing as any unevenness will render the seat practically useless.

(3) Place a piece of emery cloth or a very fine sandpaper on a firm flat surface, preferably glass.

(4) Holding the seat firmly, rub the seat facing across the paper evenly to assure getting an even surface and at the same time removing the indentation in the seat.

g. ADJUSTMENT OF SAFETY VALVE ADJUSTING SCREW. After setting regulator for proper operating pressure as in 44e (15) (b), turn regulator adjusting screw counterclockwise until the safety valve begins to bleed. Turn the regulator adjusting screw clockwise until the safety valve stops bleeding. Tighten locking nut.

#### 45. To Replace Regulator Tubing Connections

a. Unscrew the tube sleeve (fig. 7, part 3) and pull sleeve off the old tubing. Two wrenches will be necessary. To unscrew the sleeve on the regulator end of the tubing, fasten the hexagonal nut to the regulator as tightly as possible. Then, holding the nut securely

with a wrench, unscrew the tube sleeve using a second wrench. The same procedure will be used when replacing the sleeve.

b. After the sleeves have been removed, cut about 1 inch of the tubing off evenly. Put the end of the tubing into the unthreaded end of the sleeve.

c. While twisting, force the tubing about half way through the tube sleeve, up to the point where the threaded section starts. Be sure the cloth cover does not peel back.

d. Sometimes an old piece of tubing which has become stretched will not go into tube sleeve without the cloth peeling back.

(1) In such a case, slit the end of the tubing lengthwise about 1 inch and peel the cloth back from the rubber that far.

(2) Cut the exposed rubber tubing off.

(3) Pull the cloth back over the end and it will serve as a lead for threading through the tube sleeve. Use pliers to pull the tubing all the way through the tube sleeve.

(4) Cut end of the tubing and cloth off evenly and then carefully pull the tube sleeve off the tubing until the end of the tubing is even with the start of the threaded section.

e. Put a small amount of rubber cement on the outer smooth tapered part of the tube connection (fig. 7, part 1). Be sure the threads on both connections are clean.

f. Put the tube sleeve with tubing over this connection and as it is screwed manually back into place let the rubber tubing revolve freely so it will not hold as the tube sleeve goes forward.

g. After tightening it firmly with the fingers, use a wrench to finish tightening. When finished, tubing should withstand a strenuous pull without coming loose from the connections.

#### 46. To Repair Yoke Check Valve

a. Loosen screw which holds stabilizing rod to the yoke.

b. Remove yoke from operating head.

c. Yoke plunger and check valve are removed by tipping the yoke.

d. Insert new plunger or check valve.

e. Replace yoke with a new large fiber washer in the union between the yoke and operating head.

## PART THREE — B

### MAINTENANCE INSTRUCTIONS (HEIDBRINK)

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#### Section XVI. GENERAL

##### 47. Scope

Part Three—B contains information for the guidance of the personnel of the using organization responsible for the maintenance (first and second echelon) of the Heidbrink military model No. 685 portable anesthesia apparatus. It contains information needed for the performance of maintenance service.

#### Section XVII. SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

##### 48. General

There are no special organizational tools or equipment.

#### Section XVIII. LUBRICATION

##### 49. Lubrication

The portable anesthesia apparatus needs no lubrication with the exception of the absorber valve chamber which is coated with petrolatum when necessary. (See par. 67*b* (9) .)

**Caution.** Never grease or oil any part of the apparatus except as specially noted because both oxygen and nitrous oxide support combustion and the grease and oil may be ignited by the heat generated on opening the high-pressure cylinder.

#### Section XIX. PREVENTIVE MAINTENANCE

##### 50. General Information

Preventive maintenance services as prescribed by Army Regulations are a function of using echelons of maintenance.

##### 51. Before Operation Services

*a.* Check the soda lime canister on the apparatus for soda lime. If soda lime is found to be caked or excessively moist, remove and replace with fresh soda lime. (See par. 21*a.*)

*b.* Check to be sure extra soda lime canister is available and is filled with fresh soda lime.

*c.* Check *all* cylinders for proper gas content, and ease in opening and closing valves.

d. If the humidity is low, rinse breathing tubes and rebreathing bag with water; drain, and replace while moist.

## 52. After Operation Services

- a. All rubber parts must be washed. (See par. 61.)
- b. Hang breathing tubes up straight and keep all rubber goods in a cool dark place.
- c. Never store apparatus near radiator as this will damage rubber parts.
- d. Remove ether from the apparatus at the end of the day's schedule. Ether may be left in the apparatus for a short time between operations, but the ether vaporizer must be completely shut off.
- e. At the end of each operating day during which ether was used, rinse ether wick and jar with water and allow to dry.
- f. If the apparatus is used infrequently, remove soda lime and store in a closed container.
- g. Do not cover gas machine or gas cylinders with any fabric because removal of the material may cause a spark which could ignite any ether vapor which might be near the apparatus.

## 53. Monthly Operation Services

Once a month, or periodically as often as it is found necessary under local conditions, all unions should be checked and tightened where necessary to prevent loss of gas. (See par. 62.)

# Section XX. TROUBLE SHOOTING

## 54. Any Valve or Moving Part Becomes Sticky or Does Not Operate Smoothly

- | <i>Possible causes</i>     | <i>Possible remedies</i>                         |
|----------------------------|--|
| a. Dirt in part of valve.  | Clean with carbon tetrachloride or scrape clean. |
| b. Binding of moving part. | Realign, or replace part.                        |

## 55. Leak in Apparatus

- | <i>Possible causes</i>           | <i>Possible remedies</i>                       |
|----------------------------------|--|
| a. Leak in high-pressure system. | Find and repair leak. (See pars. 62c and 62d.) |
| b. Leak in breathing system.     | Find and repair leak. (See par. 62b.)          |

## 56. Flowmeter Does not Drop to "0" Position When Needle Valve is Shut Off

- | <i>Possible causes</i>       | <i>Possible remedies</i>         |
|------------------------------|----------------------------------|
| a. Dirt in flowmeter.        | Clean flowmeter. (See par. 64a.) |
| b. Faulty needle valve seat. | Replace seat. (See par. 63a.)    |



## 57. High-Pressure Gauge Does Not Return to "0" When Gas is Off

- | <i>Possible causes</i>                                     | <i>Possible remedies</i>                                |
|--|---|
| a. Indicator hand set incorrectly on stem.                 | Remove and replace in correct position. (See par. 68b.) |
| b. Cylinder shut-off valve leaking in the closed position. | Replace cylinder if leak is severe.                     |

## 58. Safety Valve on Regulator Pops Off

- | <i>Possible causes</i>   | <i>Possible remedies</i>                                   |
|--|--|
| a. Leak in regulator seat.   | Replace valve seat. (See par. 68c.)                        |
| b. Seat in safety valve not sealing.                                     | Replace safety valve.                                      |
| c. Spring in safety valve fatigued.                                      | Replace safety valve.                                      |
| d. Setscrew on safety valve out of adjustment.                           | Replace safety valve or readjust setscrew. (See par. 68g.) |
| e. Regulator adjusting screw adjusted so that the pressure is too great. | Readjust regulator adjusting screw. (See par. 68f.)        |

## 59. Needle Valves Do Not Shut Off Flow of Gas to Flowmeter

- | <i>Possible causes</i>               | <i>Possible remedies</i>                                     |
|--------------------------------------|--|
| a. Defective needle valve seat.      | Replace needle seat. (See par. 63a.)                         |
| b. Foreign particles in valve seat.  | Remove particles and replace seat if scored. (See par. 63a.) |
| c. Needle valve seat or stem scored. | Replace seat or stem. (See par. 63.)                         |

# Section XXI. MAINTENANCE OPERATIONS

## 60. To Sterilize Rubber Parts

To sterilize the rubber parts of the apparatus after use, wash in soap and water, rinse thoroughly, dry, and sterilize by dipping in an aqueous sterilizing solution, and hang up to drain. *Never autoclave any rubber parts.*

## 61. To Clean Apparatus

- a. Soda lime deposits may be removed with a weak solution of ammonia and water.
- b. Rubber parts may be washed in soap and water, but should be thoroughly rinsed and dried as soap deteriorates rubber.
- c. The ether jar and wick are rinsed out with water and then allowed to dry.
- d. Any sticky valve or moving part which does not work easily should be scraped clean or cleaned with carbon tetrachloride. Be

sure that the hands are not greasy, because even a slight film of oil in the high-pressure gas system may be ignited by the heat generated on opening the high-pressure cylinder. Since oxygen and nitrous oxide support combustion, a fire and explosion hazard would be created.

*e.* Any part that becomes dirty may be cleaned with carbon tetrachloride.

## **62. To Find and Repair Leaks in Apparatus**

*a.* **GENERAL.** A leak in the high-pressure or breathing system is the most common trouble with the apparatus. It is suggested that a solution of soapsuds be applied with a brush to any part where a leak is suspected. Leaks are indicated by the appearance of bubbles. A slow leak may not cause bubbles for a minute or two. Remove the soapsuds to prevent stickiness or deterioration of rubber parts. Leaks at gaskets or washers may be stopped by tightening the connection or packing nut, or replacement of washer or gasket.

*b.* **TO CHECK LEAKS IN BREATHING SYSTEM.** (1) Continual loss of pressure from the rebreathing bag during anesthesia indicates that pressure is being lost between the flowmeter needle valve and the face inhaler Y.

(2) To locate the leak, close the face inhaler Y combination air and shut-off valve.

(3) With the lung inflation handle in the "DOWN" position and the control valve of the ether vaporizer open, fill the rebreathing bag to a slight distention. If within 10 minutes the bag shows deflation, there is a leakage.

(4) Test for leaks by applying soapsuds at the following points and tighten the connections, repair, or replace the part, if a leak is noted.

- (a) Flowmeter valve stem packing nuts.
- (b) Back manifold bolt.
- (c) Flowmeter gasket.
- (d) Union nuts at the bottom of the flowmeter.
- (e) Union nuts of metal supply tubes connecting yokes to the flowmeters.
- (f) Absorber union nut.
- (g) Packing nut on absorber control handle shaft.
- (h) Around the top rim of the soda lime canister. See that the three canister lock screws are tight.
- (i) Around the knurled rim of the inspiratory and expiratory valves.
- (j) Pressure limiting valve and lung inflation valve on the side of the expiratory valve.
- (k) Ether vaporizer union nut, ether jar top, knurled dial rim, funnel, funnel plug, control valve stem and packing nut.
- (l) All over rebreathing bag, and rebreathing bag connection.
- (m) All over inhaler tubings and face inhaler Y.

(5) Turn the absorber control valve handle. It should work smoothly.

(6) Test for leakage in the face inhaler Y combination air and shut-off valve and expiratory valve.

(a) Check the face inhaler Y combination air and shut-off valve in the open position.

(b) Test the front facing of this valve by holding the hand over the face mask outlet connection and putting soapsuds over the ports in the hex nut. If bubbles develop, the front facing of this valve is deficient. The valve is in this position during anesthesia and therefore should be checked in this manner.

(c) Test the expiratory valve by holding the hand over the face mask outlet connection and putting soapsuds over the ports of the valve. Bubbles will indicate a leak in the valve.

(7) Test expiratory and inspiratory valves for leakage.

(a) Disconnect the face inhaler Y from the inhaler tubing.

(b) Breathe in and out of the inspiratory valve. If the inspiratory valve does not leak it will be possible to breathe from the apparatus, but not into it.

(c) Breathe in and out of the expiratory valve. If the expiratory valve does not leak it will be possible to breathe into the apparatus, but not from it. The lung inflation valve handle must be "DOWN."

c. TO CHECK FOR LEAKS IN HIGH-PRESSURE SYSTEM USING SMALL CYLINDERS. (1) Close the flowmeter needle valve of the gas selected and then open the small cylinder valve. Check to see that the flowmeter needle valve is not leaking by noting if the flowmeter stays at "0."

(2) Turn the small cylinder valve off, and if the needle in the high-pressure gauge begins to drop, a high-pressure leak is indicated.

(3) Open the small cylinder valve again and test the outlet of the flowmeter head with soapsuds to make sure that the leak is not through the needle valve even though it is in the off position. It will be necessary to remove the absorber assembly.

(4) Check with soapsuds the union of the cylinder to the yoke, particularly around the small fiber washer.

(5) Make certain the yoke plug is in place and tight on the intercommunicating yoke. There should be a small fiber washer at this connection.

(6) Check with soap suds around the high-pressure gauge.

(7) Close the cylinder valve and check around the cylinder valve stem for a leak in the packing.

(8) Tighten any leaky unions and replace gaskets if necessary.

(9) If a leak at a union of a small cylinder and small cylinder yoke still persists—

(a) Remove cylinder.

(b) Remove all of the washer.

(c) Examine the face of the cylinder valve to be sure that there are no deep scratches in the valve where it contacts the washer.

(d) Examine the concentric indentations around the cylinder valve outlet to be sure the washer particles have not been compressed into it.

(e) Examine the concentric rings in the hex nut to be sure that the particles have not been compressed into the channel. Do not scratch the face of this nut.

(10) Check for leaks in the yoke check valve.

(a) If the pressure in the cylinder in the opposite yoke is below 500 pounds there may be a slight leakage which is unavoidable because of the construction of the check valve. Such leakage will not be consequential while replacing a cylinder. At other times all yokes should always be occupied by a cylinder or yoke plug.

(b) In testing remove cylinder from one hanger yoke and open a cylinder containing over 500 pounds pressure in the opposite communicating yoke.

(c) Apply soapsuds over the outlet of the yoke intake screen in the empty yoke. If bubbles indicate a rapid leak, replace the check valve. (See par. 69.)

(d) Test each yoke separately.

d. TO TEST FOR LEAKS IN HIGH-PRESSURE SYSTEM WHEN USING LARGE CYLINDERS. (1) Close the flowmeter needle valve of the gas selected, open the high-pressure tubing shut-off, and open the cylinder valve. Check to see that the needle valve is not leaking by noting if the flowmeter stays at "0."

(2) Close the cylinder valve, and if the needle of the high-pressure gauge on the regulator starts to drop, a high-pressure leak is indicated. The leak will be located somewhere from the cylinder valve packing down to, and including the flowmeter needle valve stem seat.

(3) Check the cylinder valve packing with soapsuds. If there is a leak at this point, tighten the hex packing gland nut directly beneath the cylinder valve handwheel.

(4) Open the cylinder valve and test at the union of the regulator and cylinder valve, at safety valve, and at the high-pressure gauge union with the casting.

(5) Test the holes in the bell cap of the regulator. Bubbles forming at the holes of the bell of the regulator indicate that the regulator diaphragm is perforated or leaking. (See par. 68e.) Test the hex union of the regulator tubing to the regulator. No washer is necessary at this union.

(6) Test the connections at both ends of the regulator tubing. Check aperture in the regulator tubing shut-off valve for a valve stem seat leak.

(7) Tighten all loose unions and replace deficient gaskets as indicated above.

### 63. To Repair Needle Valve

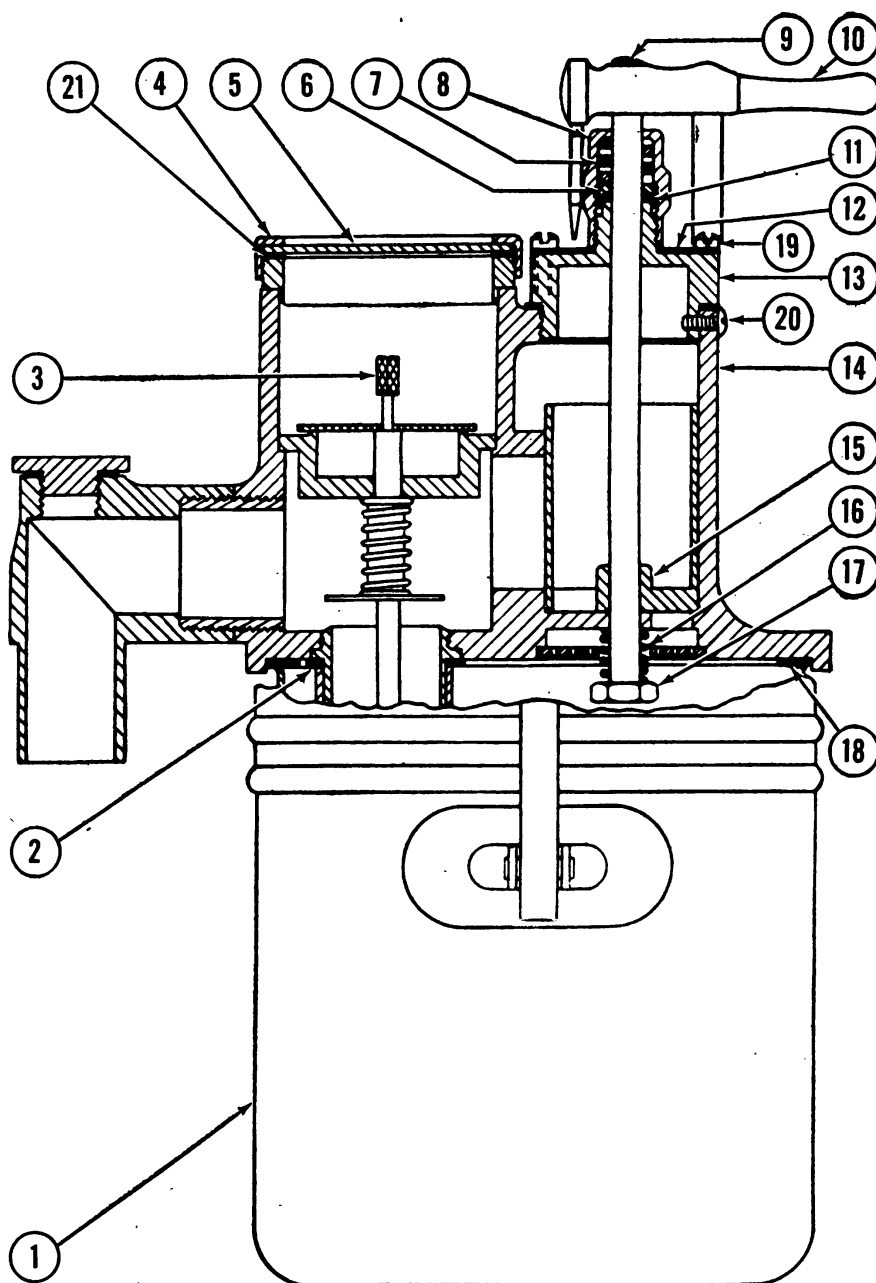
a. NEEDLE VALVE SEAT REPLACEMENT. (1) Unscrew stem all the way out. Do not pull through the packing.



- (2) Screw out hex stud guide.
  - (3) Unscrew brass needle valve seat retainer.
  - (4) Remove seat from well by using the flowmeter needle valve stem. Insert the stem gently but firmly in seat center and lift out seat.
  - (5) Replace with new seat.
  - (6) Replace brass needle valve seat retainer.
  - (7) Replace hex stud guide and hex stud guide washer.
  - (8) Replace needle valve stem, turning clockwise as it is pushed through the packing.
- b. NEEDLE VALVE STEM REPLACEMENT. (1) Unscrew stem all the way out. Do not pull through the packing.
- (2) Replace by screwing down into place.
- c. NEEDLE VALVE STEM PACKING REPLACEMENT. (1) Unscrew needle valve stem. (See par. 63b.)
- (2) Separate hex cap nut from hex stud guide.
  - (3) Remove and examine packing washers in packing cup.
  - (4) If three disks which are in good condition are found, add one.
  - (5) If four disks, put in four new ones.
  - (6) Screw nut partly back on hex stud guide.
  - (7) Screw in stem. Do not push through packing.
  - (8) Tighten nut and test for leakage.

#### 64. To Repair Flowmeter

- a. CLEANING FLOWMETER. (1) Loosen by turning clockwise hex union nut at bottom of the flowmeter. Note gasket.
- (2) Screw out the hex bolt in back of flowmeter. Note gasket.
  - (3) With clean and dry hands, invert flowmeter and with a knife or screw driver carefully remove float retention ring.
  - (4) Carefully drop float into the hand.
  - (5) Handle float gently and wipe it off with a clean lintless cloth.
  - (6) Wipe out glass float tube with a pipe cleaner.
  - (7) Wipe out inside wall of tapered tube with a pipe cleaner which has been doubled. Leave no lint or fragments within these tubes. Never blow the breath into the tube, as moisture will be precipitated which might prevent free action of the float. Should the float be damaged, replace with a new one. Oxygen and nitrous oxide flowmeter rods are not interchangeable.
  - (8) To replace the float, invert the flowmeter and drop into taper tube. Do not press on it. Shake the flowmeter gently until the float drops into place.
  - (9) Replace retention ring.
  - (10) Replace flowmeter in base and engage threads.
  - (11) Screw up on bolt in back of flowmeter.
  - (12) Tighten hex union nut at the bottom of the flowmeter.
- b. REPLACING BROKEN GLASS FLOWMETER TUBE. (1) Remove flowmeter from head. (See par. 64a.)
- (2) Remove hex nut from top of flowmeter.



<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>	<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>
1. 9R03231	Canister, Soda Lime	12. 9R03239	Dia, Indicating, Absorber Control
2. 9R03126	Gasket, Absorber Down Tube, Rubber	13. 9R03240	Cap, Absorber Control Valve
3. 9R03252	Nut, Inspiratory Valve, Knurled	14. 9R03267	Casting, Absorber
4. 9R03245	Base, Retaining, Inspection Window	15. 9R03244	Valve, Absorber Control
5. 9R03144	Window, Inspection, Check Valve, Plastic	16. 9R03243	Spring, Absorber Control Valve
6. 9R03195	Cup, Packing	17. 9R03242	Nut, Locking, Hex., Absorber Control Valve
7. 9R033243	Sprng, Absorber Control Valve	18. 9R03124	Gasket, Soda Lime Canister
8. 9R03235	Nut, Packing, Hex.	19. SR00914	Screw, 6-32 x 3/16 Inch, Fill. H. M., 144 to Pkg. For absorber control name plate.
9. SR00040	Screw, 6-32 x 1/4 Inch, 144 to Pkg.	20. SR00989	Screw, 8-32 x 5/16 Inch R. H. M., 144 to Pkg.
10. 9R03234	Handle Absorber Control	21. 9R03146	Gasket, Check Valve Inspection Window, Rubber
11. 9R03142	Disk, Packing		

*Figure 8. Absorber, side view, Heidbrink.*

- (3) Remove brass plug from top of flowmeter.
- (4) Disassemble flowmeter completely.
- (5) Clean out any debris from all parts of the flowmeter.
- (6) Place new tube into flowmeter through the opening in the top with the open end down.
- (7) Replace brass plug, being careful that it fits over the end of the glass tube so that the tube is centered on the brass plug. The small raised knob in the brass plug must fit into the indentation in the closed end of the glass tube.
- (8) Reassemble and replace flowmeter.

#### **65. To Remove and Replace Ether Jar and Wick**

- a. Unscrew jar by turning clockwise until free.
- b. Pull wick straight down.
- c. Replace wick by pushing straight up over vertical tubing.
- d. Replace jar by turning counterclockwise until tight. Be sure gasket in jar ring is in place.

#### **66. To Repair High-Pressure Tubing**

If tightening union nuts fails to stop leak at tubing unions or the rubber tubing leaks, put on a new tubing; do not patch.

#### **67. To Repair Absorber Assembly**

- a. CONTROL VALVE STEM PACKING. (1) Remove screw (fig. 8, part 9), handle (fig. 8, part 10), packing nut (fig. 8, part 8), spring (fig. 8, part 7), packing cup (fig. 8, part 6), and packing disks (fig. 8, part 11). (See fig. 8.)
- (2) If packing disks appear to be good and there are three, add one disk.
- (3) If there are four, put in four new disks.
- (4) Assemble all parts in reverse order, being careful that disks go inside packing cup and cup is put on bottom up.
- b. CONTROL VALVE. (1) Detach ether vaporizer and tubings from the absorber.
- (2) Remove screw (fig. 8, part 9), handle (fig. 8, part 10), packing nut (fig. 8, part 8), spring (fig. 8, part 7), packing cup (fig. 8, part 6), and packing disk (fig. 8, part 11).
- (3) Remove any dial screws (fig. 8, part 19) and dial (fig. 8, part 12).
- (4) Remove lock screw (fig. 8, part 20).
- (5) Remove valve cap (fig. 8, part 13). A spanner wrench is necessary to remove the valve cap.
- (6) Remove absorber canister (fig. 8, part 1). (See par. 21a.)
- (7) Remove nut (fig. 8, part 17). Spring (fig. 8, part 16) will drop out.
- (8) Grasp top end of stem of valve (fig. 8, part 15) and pull valve out.
- (9) Clean outside surface and walls of valve chamber using

carbon tetrachloride. Apply a thin film of petrolatum on the walls of the valve chamber and outside surface of the valve.

(10) Replace valve.

(11) Screw on cap (fig. 8, part 13) tightly, being sure lock screw hole lines up with screw hole in body, and put in screw (fig. 8, part 20). Replace gasket (fig. 8, part 21).

(12) Replace dial (fig. 8, part 12) and dial screws (fig. 8, part 19).

(13) Put packing disks (fig. 8, part 11) in cup (fig. 8, part 6), invert it (disks down) and place it with spring (fig. 8, part 7) on valve stem.

(14) Screw nut (fig. 8, part 8) on tightly. If dial has no retaining screws, position it with calibration "4" in front and centrally located between inspiration and expiration valves and hold thus while tightening the nut.

(15) Using handle (fig. 8, part 10) as a wrench, turn stem of valve until bottom part of valve is closed, as viewed through perforated metal. If pointer of the handle is not now at "Shut" remove it and put it back on, so pointer is at "Shut."

(16) Replace screw (fig. 8, part 9) tightly.

(17) Place spring (fig. 8, part 16) on bottom end of stem and screw on nut (fig. 8, part 17) until it binds snugly.

(18) Put on canister with long clamp screw at front.

c. CANISTER GASKET. (1) Loosen canister screws and remove canister by pulling arms away from canister.

(2) If gaskets (fig. 8, part 18 and part 2) appear undamaged, clean off any corrosion around edge of canister and tube which seal against the gaskets.

(3) Inspect edge of canister for dents or particles.

(4) Replace canister and test. If there is still leakage, put in new gaskets.

d. CHECK VALVE DISK. (1) Success with the absorber depends upon keeping the inspiratory and expiratory valves clean. If the check valve disk of either valve appears to stick and not to "flicker" freely due to a gummy deposit from the soda lime, it must be cleaned.

(2) Remove the bezel, plastic inspection window, and gasket of the valve chamber.

(3) Swab out the valve chamber and check valve disk with a weak solution of ammonia and water.

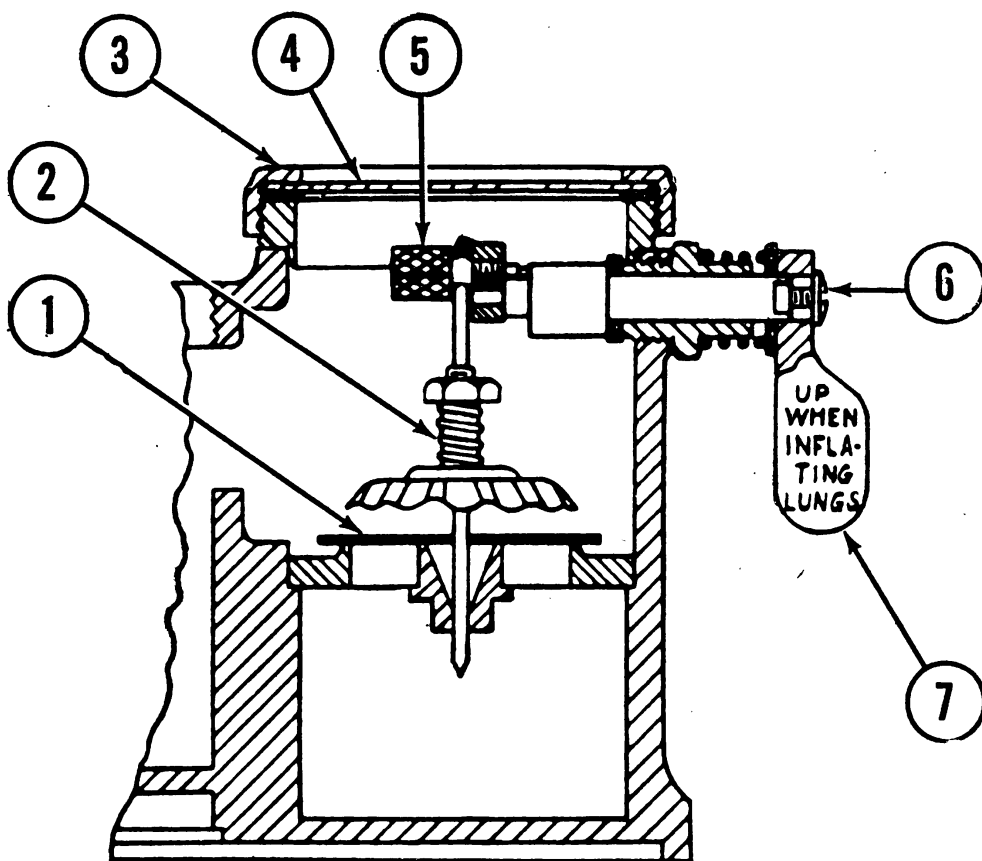
e. INSPIRATORY VALVE. (1) Remove bezel (fig. 8, part 4), plastic inspection window (fig. 8, part 5), and gasket (fig. 8, part 21).

(2) Remove knurled screw (fig. 8, part 3) and push rod assembly.

(3) Remove check valve disk and replace with a new one.

(4) Replace parts in reverse order. Do not forget gasket (fig. 8, part 21).

f. EXPIRATORY VALVE. (1) Screw off bezel (fig. 9, part 3), plastic inspection window (fig. 9, part 4) and gasket.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 9R03148	Disk, Check Valve	5. 9R03248	Screw, Lung Inflation Valve, Knurled
2. 9R03251	Push-rod, Lung Inflation Valve, Complete	6. SR00040	Screw, 6-32 x 1/4 Inch, R. H. M., 144 to Pkg.
3. 9R03245	Bezel, Retaining, Inspection Window	7. 9R03246	Handle, Lung Inflation Valve
4. 9R03144	Window, Inspection, Check Valve, Plastic		

Figure 9. Lung inflation and expiratory valve, Heidrink.

- (2) Screw off knurled knob. (See fig. 9, part 5.)
- (3) Remove and replace check valve disk.
- (4) Replace parts in reverse order.

g. **PRESSURE LIMITING VALVE.** If adequate equipment for measuring gas pressure is not available, loosen lock screw and tighten down cap to the limit, thus closing the valve; or replace with a new valve.

h. **LUNG INFLATION VALVE.** (1) Remove screw (fig. 9, part 6) and handle (fig. 9, part 7).

(2) Stretch spring slightly.

(3) Replace handle (fig. 9, part 7) and screw (fig. 9, part 6).

## 68. To Repair Regulator

a. **GAUGE.** (1) If defective, replace with a new one.

(2) Coat threads on new gauge with litharge and glycerin being careful not to get any in or on stud end, and screw into place.



**Note.** When installing parts such as gauges, safety valves, or similar parts which are not ground connections or do not use a washer or gasket to make them gas tight, a luting compound of litharge and glycerin may be used. This compound dries in a short time into a hard cement. It is made by placing a small amount of litharge in a container and adding glycerin until a thick paste is formed. The advantage of a thick paste being that it dries quicker and speeds up repair. Place the litharge and glycerin on the first three or four threads of the part and thread into the opening by hand three or four turns. Rotate the part back and forth several times to be certain that the litharge and glycerin has penetrated the threads thoroughly. The litharge and glycerin should set for at least 30 minutes before retesting the equipment. When tightening the part, do not use too much pressure, only enough so that the part is firmly in place. If it is screwed in too tightly, it will be impossible to remove. In removing the part it is necessary to tap the base lightly all the way around with a ball peen hammer. This will crack the cement and permit removal of the part.

**Caution:** Under no circumstances should conventional luting compounds be employed in place of the litharge and glycerin. These are highly combustible in contact with pure oxygen and are very likely to produce spontaneous combustion. Mixtures containing white lead, linseed oil, etc., are prohibited.

b. **ADJUSTING HIGH-PRESSURE GAUGE TO ZERO.** (1) Be sure there is no pressure on the line.

(2) Remove glass crystal from gauge by unscrewing the metal rim counterclockwise.

(3) Remove indicator hand from the axle using two small screw drivers to force it off.

(4) Replace indicator hand on the shaft to register "0." Tap gently into place.

(5) Replace rim and crystal by screwing it on the rim clockwise.

c. **REMOVAL AND REPLACEMENT OF REGULATOR SEAT.** (1) Remove hex cap nut (fig. 10, part 1) at the back of the regulator. Remove spring (fig. 10, part 2) and regulator seat (fig. 10, part 3).

(2) Open cylinder briefly to blow out debris.

(3) Wipe out valve chamber with clean, lintless cloth.

(4) Examine nozzle exposed by removing seat. If damaged, remove bell cap (fig. 10, part 7) and loose parts including the diaphragm (fig. 10, part 4), exposing hex (fig. 10, part 10) of nozzle (fig. 10, part 5).

(5) Unscrew nozzle and replace with new one.

(6) Put in new seat.

(7) Assemble all parts in reverse order. Keep all connections tight.

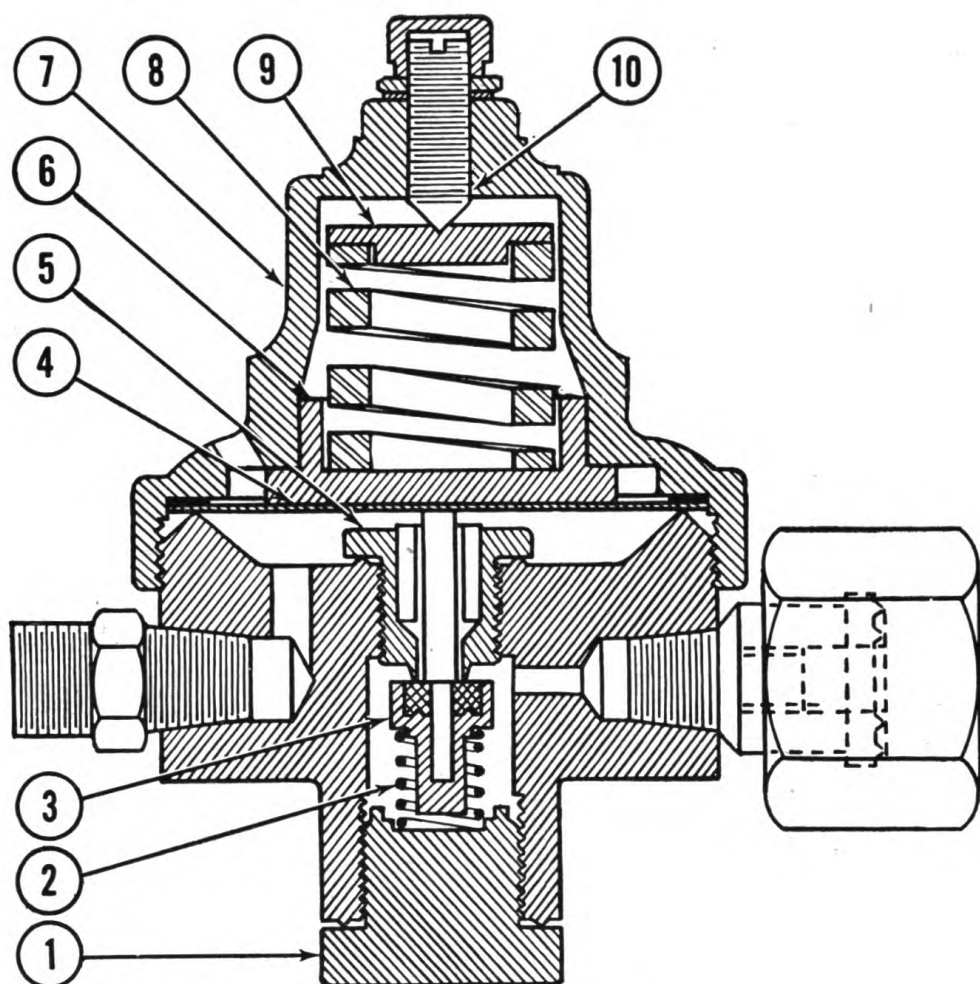
(8) No readjustment of regulator is necessary with this repair.

d. **SAFETY VALVE.** (1) Leakage usually indicates a defective regulator seat which first should be replaced with a new one. If this does not stop leak, repair or replace safety valve. However, be sure that the leakage is not due to excess pressure as a result of the regulator adjusting screw being screwed in too far.

(2) Screw off knurled body with the fingers. If necessary, use pliers, carefully.

(3) Clean valve seat or preferably replace with new one.

(4) Do not change adjustment of screw at bottom of knurled body.



Med. Dept.  
No.                      Nomenclature  
1. 9R03310 Nut, Cap, Hex., Regulator Valve Seat  
2. 9R03311 Spring, Regulator, Valve Seat  
3. 9R03128 Seat, Regulator  
4. 9R03130 Diaphragm, Regulator, Copper  
5. 9R03312 Nozzle, Regulator

Med. Dept.  
No.                      Nomenclature  
6. 9R03308 Cap, Distributing, Diaphragm Spring  
7. 9R03305 Cap, Bell, Regulator  
8. 9R03307 Spring, Diaphragm, Regulator Valve  
9. 9R03306 Cap, Diaphragm Spring  
10. 9R03304 Screw, Adjusting, Regulator

Figure 10. Regulator, Heidbrink.

(5) Reassemble and test. If leak still persists, loosen the locking nut and tighten screw adjustment in bottom of knurled body. Replace with new valve as soon as possible.

(6) Tighten locking nut.

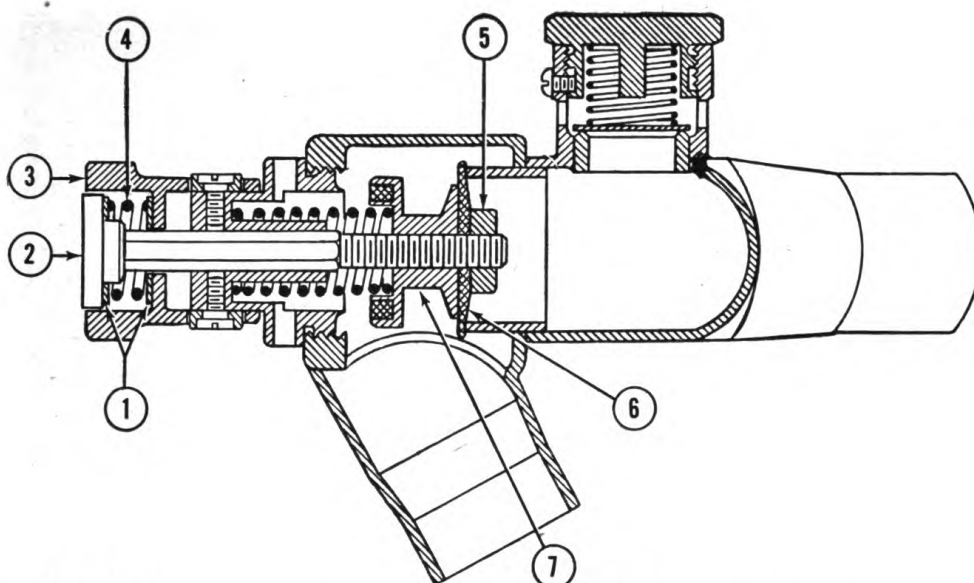
e. DIAPHRAGM. (1) Tighten down bell cap (fig. 10, part 7) with wrench. This may stop a leak in the diaphragm.

(2) If leak is not stopped by step (1), release tension on regulator adjusting screw (fig. 10, part 10) and screw off the bell cap (fig. 10, part 7).

(3) Remove loose parts and diaphragm (fig. 10, part 4).

(4) Paint outer rim surface of new diaphragm with litharge and glycerin. (See note in par. 68a.)

(5) Put diaphragm (fig. 10, part 4) and loose parts in place and screw bell cap (fig. 10, part 7) on firmly.



Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 9R03338	Washer, Face Inhaler Y Valve Stem Spring, Steel: $\frac{1}{16}$ -inch OD, $\frac{5}{16}$ -inch ID, $\frac{1}{64}$ inch thick	4. 9R03337	Spring, Face Inhaler Y Valve Stem
2. 9R03339	Stem, Face Inhaler Y Valve	5. 9R03331	Nut, Hex, Face Inhaler Y, Brass
3. 9R03336	Knob, Knurled, Face Inhaler Y	6. 9R03333	Seat, Face Inhaler Y Valve Head: Rubber
		7. 9R03334	Head, Valve, Face Inhaler Y

Figure 11. Face inhaler Y, Heidbrink.

f. ADJUSTMENT OF REGULATOR TO PROPER OPERATING PRESSURE.

(1) This is necessary only when the diaphragm is replaced or the regulator adjusting screw has been put out of adjustment.

(2) With cylinder valve open, turn adjusting screw clockwise until safety valve begins to leak, then turn counterclockwise two turns.

(3) An alternate method is to open the flowmeter needle valve eight turns, turn adjusting screw clockwise until the flowmeter registers at the top of the scale, then turn the adjusting screw clockwise two additional turns.

(4) Tighten locking nut on top of regulator bell.

g. ADJUSTMENT OF SAFETY VALVE ADJUSTING SCREW. (1) After setting regulator for proper operating pressure as in (3) above, turn regulator adjusting screw counterclockwise until the safety valve begins to bleed.

(2) Turn the regulator adjusting screw clockwise until the safety valve stops bleeding. Tighten locking nut.

69. To Repair Yoke Intake

a. REPLACING PLASTIC CHECK VALVE AND SPRING. (1) Unscrew the two stabilizer pins. The stabilizer parts will then drop down.

(2) Unscrew stabilizer yoke screw.

(3) Unscrew the hex nut. The check valve and spring may now be blown out by gas from the cylinder in the opposite yoke. This will also clean out the chamber.

- (4) Insert new spring and check valve.
- (5) Replace hex nut.
- (6) Replace stabilizer parts, stabilizer yoke screw, and small pins.
- b. REPLACING YOKE INTAKE SCREEN. (1) Unscrew brass yoke intake screen from the hex nut. This may be done with the fingers.
- (2) Screw a new yoke intake screen into the hex nut.

## 70. To Repair Face Inhaler Y

a. FACE INHALER Y COMBINATION AIR AND SHUT-OFF VALVE. (1) Screw out perforated hex nut and remove valve assembly.

- (2) Screw off small hex nut. (See fig. 11, part 5.)
- (3) Remove rubber seat. (See fig. 11, part 6.)
- (4) Remove brass valve head. (See fig. 11, part 7.)
- (5) Observe how remaining parts are assembled, then separate and clean thoroughly in carbon tetrachloride.

(6) If the rubber seat is damaged, replace with a new one. If the opposite seat on the brass valve head is damaged, put in new brass valve head.

(7) To assemble replace short spring (fig. 11, part 4) and washers (fig. 11, part 1) on stem. Insert in knurled knob. (See fig. 11, part 3.)

(8) Place perforated hex nut on stem so that the rollers at the bottom of the slots in the knurled knob.

(9) Replace long valve head spring.

(10) Screw brass valve head into place with rubber gasket of brass valve head towards the spring. Screw down far enough so that rubber seat (fig. 11, part 6) and the hex nut (fig. 11, part 5) may be placed on stem.

(11) Place rubber seat on stem and hold in place with hex nut. Do not tighten hex nut.

(12) Holding the perforated hex nut in the left hand, turn the knurled knob counterclockwise seven-eighths of a turn until the rollers drop into a slight depression.

(13) Screw brass valve head (fig. 11, part 7) until it lightly contacts the seat of the hex nut, and closes the air valve.

(14) Holding perforated hex nut in the left hand, turn the knurled knob clockwise as far as it will go.

(15) Screw down brass valve head (fig. 11, part 7) approximately three-quarter turn and tighten to place with small hex nut.

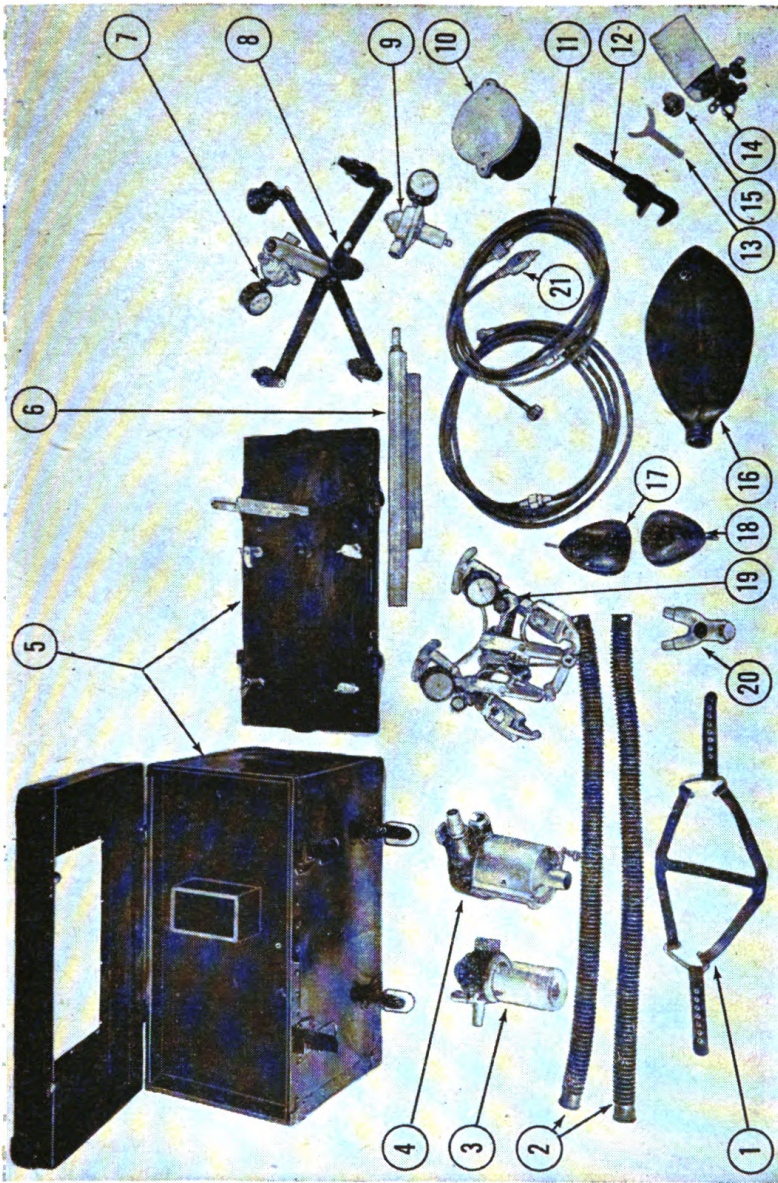
(16) Holding perforated hex nut in the left hand, turn the knurled knob counterclockwise seven-eighths of a turn until the rollers drop into a slight depression.

(17) Screw perforated hex nut back into face inhaler Y.

b. FACE INHALER Y EXPIRATORY VALVE. (1) Turn small screw counterclockwise two and a half turns.

- (2) Remove knurled valve cap, spring and valve seat.
- (3) Replace damaged valve seat.
- (4) Replace spring and knurled valve cap.
- (5) Tighten small screw.

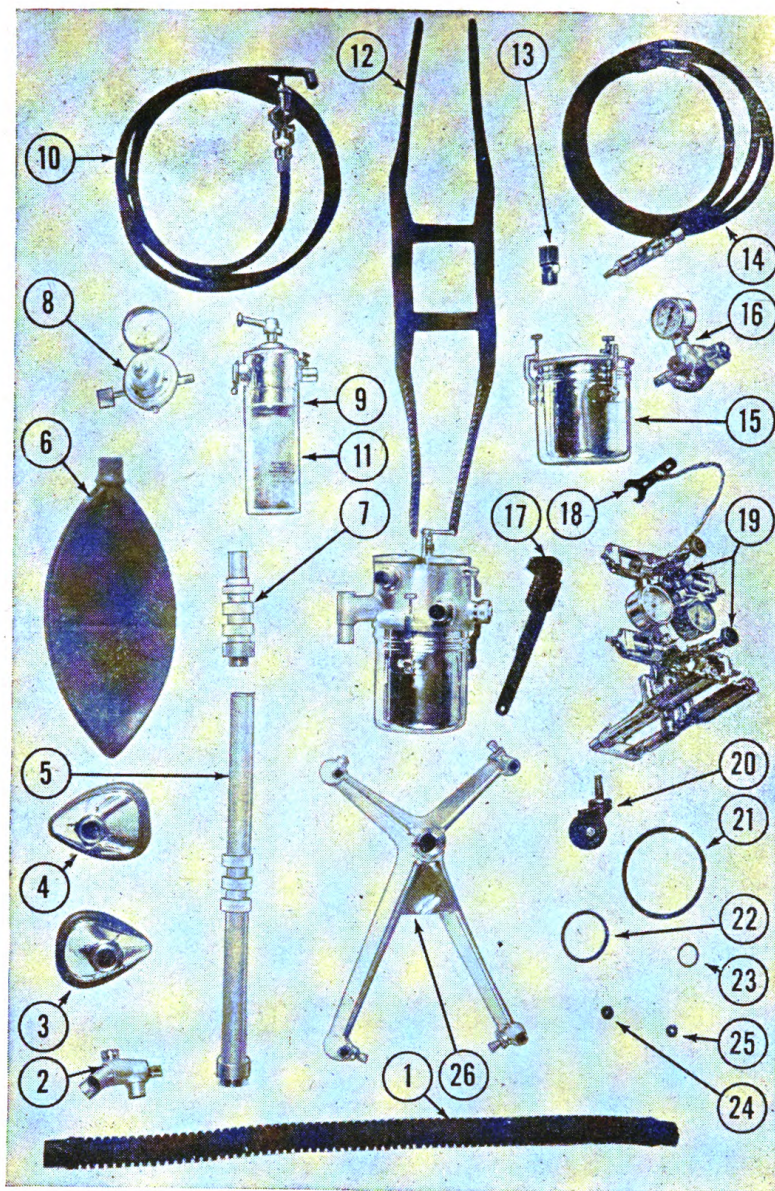




- | Med. Dept.<br>No. | Nomenclature   |
|-------------------|--|
| 1. 9R02912        | Harness, Head  |
| 2. 3608510        | Anesthesia Apparatus, Tubing for Inhaler, McKesson                               |
| 3. 9R03432        | Vaporizer, Ether, Complete   |
| 4. 9R03076        | Absorber, Complete: Assembly   |
| 5. 9R03476        | Case, Carrying, Complete: Assembly   |
| 6. 9R03047        | Tube, Upright, Base  |
| 7. 9R03460        | Regulator, 0., Complete: (Showing its position on base stand when packed)        |
| 8. 9R03046        | Base, Complete   |
| 9. 9R03461        | Regulator, N.O., Complete  |
| 10. 9R03489       | Cover, Soda Lime Canister  |
| 11. 9R03020       | Tube, Regulator, Complete  |
| 12. TR01869       | Wrench, Adjustable, Auto Type, 11-inch length, 2 $\frac{1}{2}$ -inch Jaw Opening |
| 13. TR00008       | Wrench, Spanner, Face, Anesthesia  |
| 14.               | Extra Washers  |
| 15. 7789000       | Cylinder Valve Adapter, High Pressure  |
| 16. 3605015       | Anesthesia Apparatus Bag, 5-Liter, McKesson                                      |
| 17. 3607016       | Anesthesia Apparatus Face Mask, Adult, Large, McKesson                           |
| 18. 3607015       | Anesthesia Apparatus Face Mask, Adult, Medium, McKesson                          |
| 19. 9R03053       | Head, Complete: Assembly with gauges   |
| 20. 9R03477       | Face Inhaler Y, Complete   |
| 21. 9R03497       | Valve, Shut-off  |

Figure 12. Item No. 9350000 anesthesia apparatus, portable: manufactured by McKesson Appliance Company.

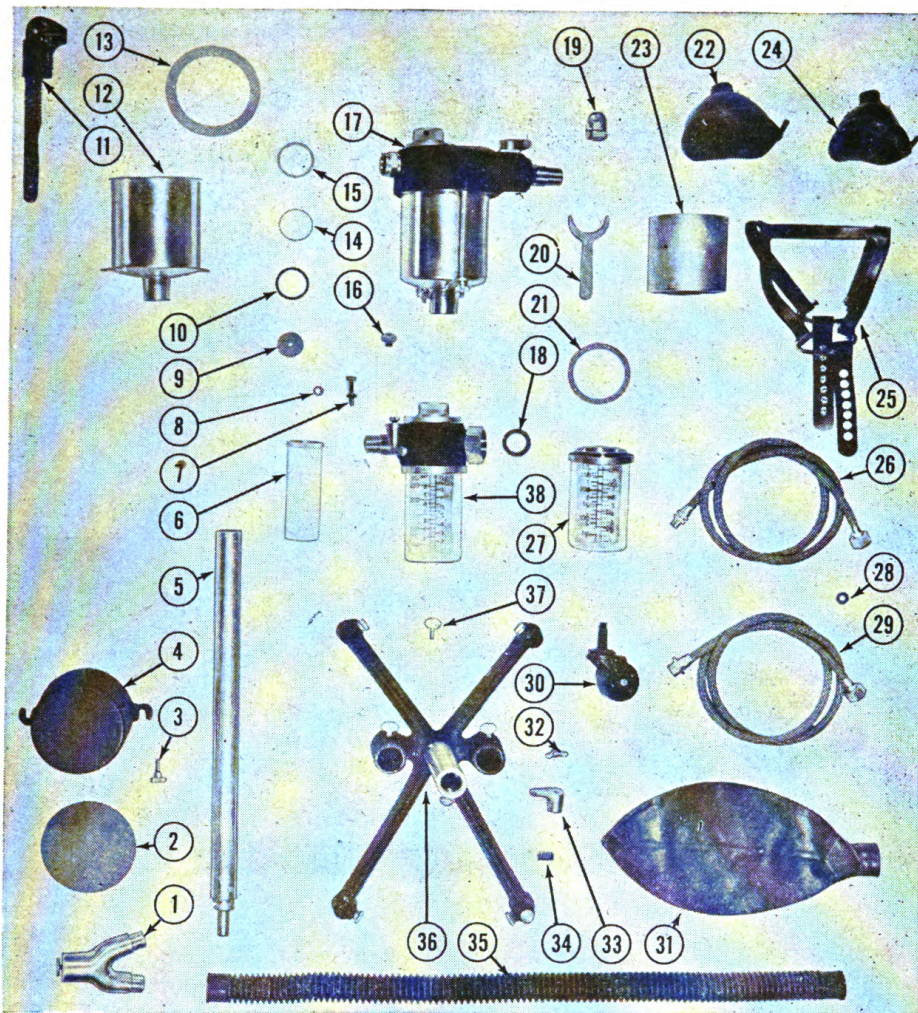




- | Med. Dept.<br>No. | Nomenclature  | Med. Dept.<br>No. | Nomenclature   |
|-------------------|---|-------------------|--|
| 1. 3638505        | Anesthesia Apparatus, Tubing for Inhaler, Heidbrink                         | 14. 9R03107       | Tubing, High-pressure, N.O. Rubber, Complete                         |
| 2. 9R03329        | Inhaler, Face Y, Complete   | 15. 9R03231       | Canister, Soda Lime  |
| 3. 9R03326        | Mask, Face, Medium, Complete  | 16. 3606010       | Anesthesia Apparatus Pressure Regulator and Gauge, Oxygen, Heidbrink |
| 4. 9R03327        | Mask, Face, Large, Complete   | 17. TR01869       | Wrench, Adjustable Auto Type, 11-inch Length, 2 5/8-inch Jaw Opening |
| 5. 9R03166        | Upright, Base Section.  | 18. TR00009       | Wrench, Plug and Yoke, Anesthesia                                    |
| 6. 3605010        | Anesthesia Apparatus Bag, 5-Liter, Heidbrink                                | 19. 9R03178       | Head, Complete   |
| 7. 9R03167        | Upright, Head Section   | 20. 9R03168       | Caster, Complete   |
| 8. 3606005        | Anesthesia Apparatus Pressure Regulator and Gauge, Nitrous Oxide, Heidbrink | 21. 9R03124       | Gasket, Soda Lime Canister   |
| 9. 9R03268        | Vaporizer, Ether, Complete  | 22. 9R03110       | Gasket, Ether Jar, Rubber  |
| 10. 9R03106       | Tubing, High-pressure, Oxygen, Rubber, Complete                             | 23. 9R03126       | Gasket, Absorber Down Tube, Rubber                                   |
| 11. 9R03108       | Jar, Ether  | 24. 9R03136       | Washer, Fiber, Large   |
| 12. 9R03328       | Headstrap, Rubber   | 25. 9R03134       | Washer, Fiber, Small   |
| 13. 7789000       | Cylinder Valve Adapter, High-pressure                                       | 26. 9R03165       | Base Casting   |

Figure 13. Item No. 9350000 anesthesia apparatus, portable: manufactured by Heidbrink Division of the Ohio Chemical & Mfg. Co.





Med. Dept.  
No.

Nomenclature

1. 9R03477 Face Inhaler Y, Complete: Assembly
2. 9R03002 Gasket, Canister Cover: For soda lime
3. 9R02996 Nut, Thumb
4. 9R03489 Cover, Soda Lime Canister
5. 9R03047 Tube, Upright, Base
6. 9R03433 Wick, Ether, Complete
7. 9R03038 Plug, Funnel, Ether Jar
8. 9R03034 Washer, Funnel Plug, Leather
9. 9R02954 Disk, Check Valve
10. 9R02950 Gasket, Inspection Window
11. TR01869 Wrench, Adjustable, Auto Type, 11-inch Length, 2 7/8-inch Jaw Opening
12. 9R02934 Holder, Bag Assembly
13. 9R02960 Gasket, Bag Holder
14. 9R02952 Window, Inspection, Check Valve, Glass
15. 9R03092 Retainer, Window
16. 9R02946 Nut, Thumb, Knurled
17. 9R03076 Absorber, Complete
18. 9R03036 Gasket, Absorber to Ether Vaporizer
19. 9R03412 Valve, Exhalation, Complete
20. TR00008 Wrench, Spanner, Face, Anesthesia

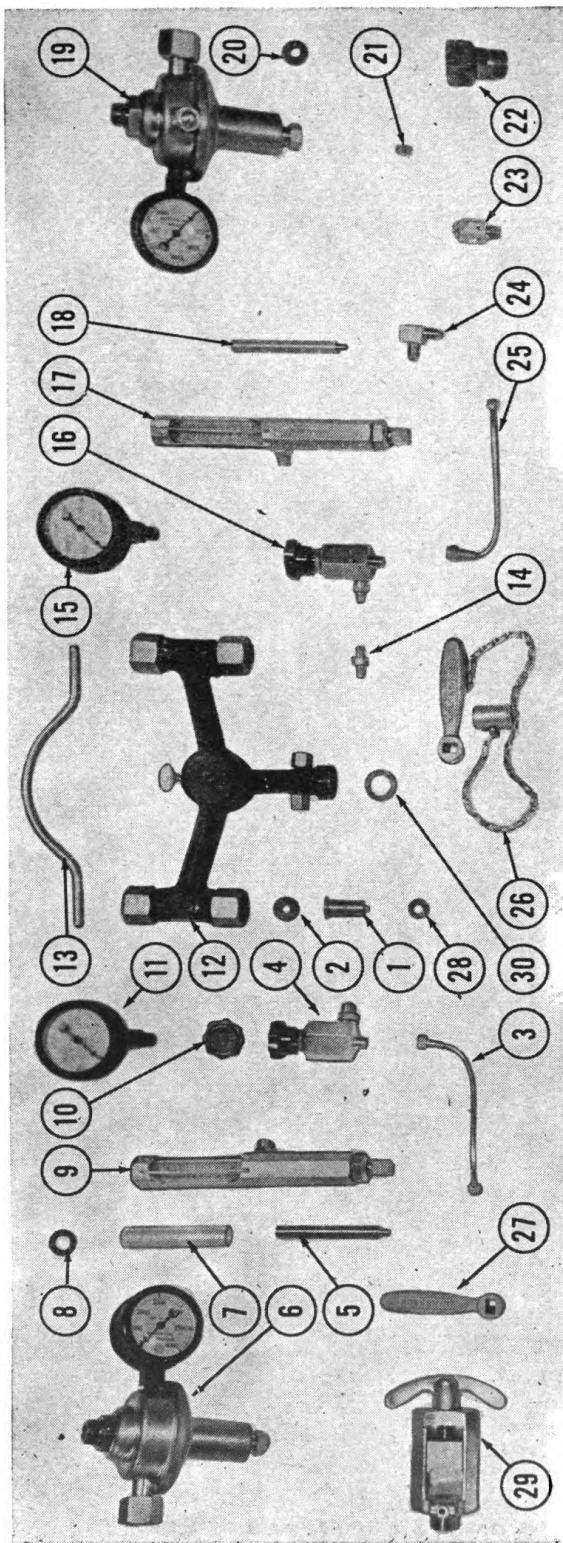
Med. Dept.  
No.

Nomenclature

21. 9R02930 Gasket, Ether Jar, Cork
22. 3607016 Anesthesia Apparatus Face Mask, Adult, Large, McKesson
23. 9R03078 Canister, Soda Lime
24. 3607015 Anesthesia Apparatus Face Mask, Adult, Medium, McKesson
25. 9R02912 Harness, Head
26. 9R03020 Tube, Regulator, Complete
27. 9R02962 Jar, Ether Vaporizer
28. 9R03134 Washer, Fiber, Small
29. 9R03022 Tube, Regulator, Extension, Complete
30. 9R03050 Caster, Complete
31. 3605015 Anesthesia Apparatus Bag, 5-liter, McKesson
32. SR00594 Nut, 1/4 x 20, Wing, 100 to Pkg.
33. 9R03048 Clamp, Base
34. 9R03049 Spring, Base Clamp
35. 3608510 Anesthesia Apparatus Tubing for Inhaler, McKesson
36. 9R03046 Base, Complete
37. SR00592 Screw, 1/4-20 x 1 1/2 inch, Thumb, 144 to Pkg.
38. 9R03432 Vaporizer, Ether, Complete

Figure 14. Item No. 9350000 anesthesia apparatus, portable: manufactured by McKesson Appliance Company.

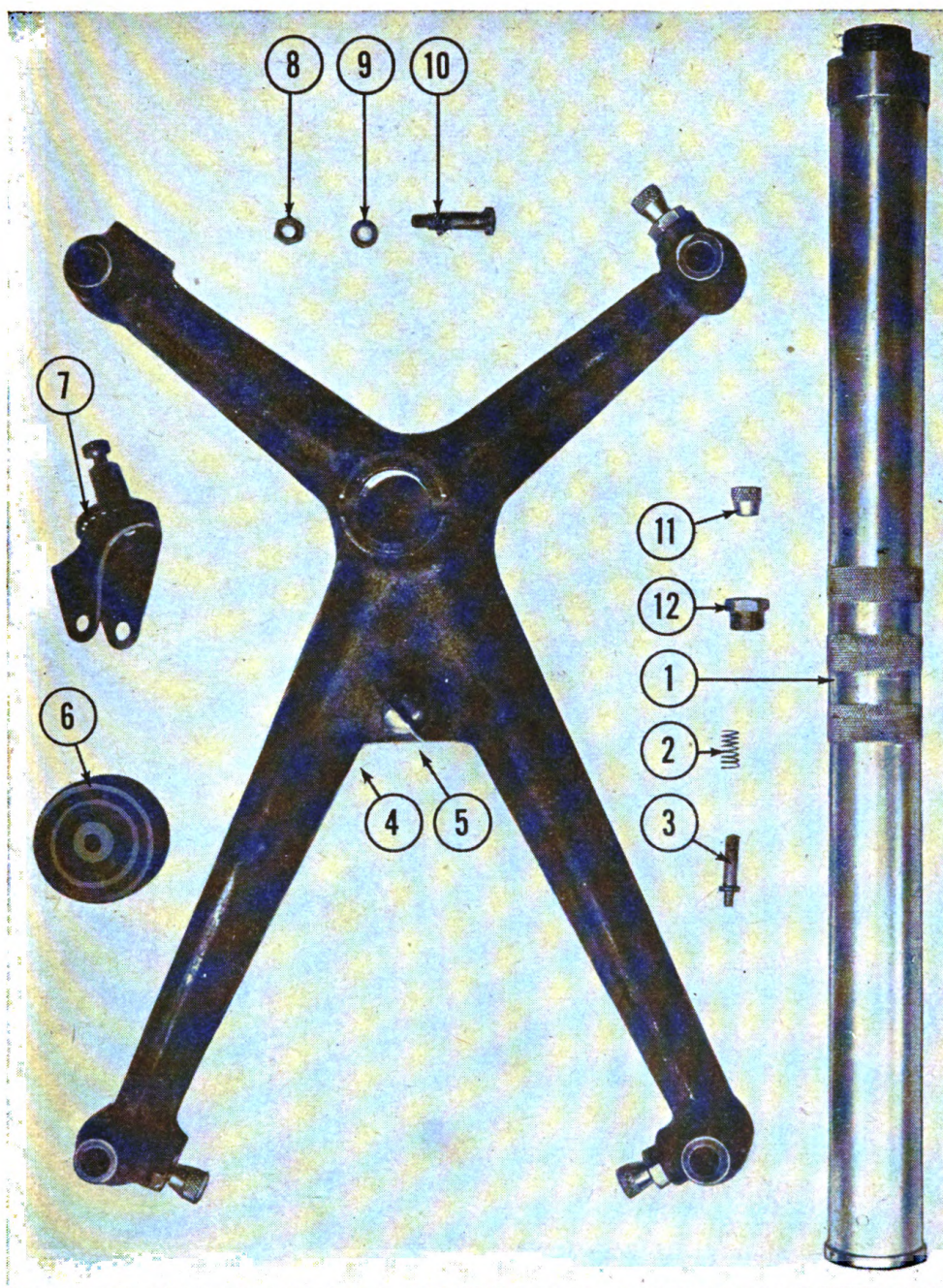




Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 9R03008	Plunger, Tank Yoke, Complete: Assembly with check valve	10. 9R03040	Knob, Needle Valve, Bakelite	20. 9R03136	Washer, Fiber, Large
2. 9R03136	Washer, Fiber, Large	11. 9R03042	Gauge, High-pressure, N <sub>2</sub> O	21. 9R02920	Seat, Regulator Valve
3. 9R02976	Tube, N <sub>2</sub> O Supply, Complete: With metal end connections	12. 9R03054	Casting, Head	22. 7793000	Cylinder Valve Adapter, High-pressure
4. 9R02972	Valve, Needle, N <sub>2</sub> O, Complete: Assembly	13. 9R03057	Rod, Stabilizing, Head	23. 9R03006	Valve, Safety Relief, Complete: Assembly
5. Flowmeter Nozzle, Part of 9R02998	Float and Nozzle, O <sub>2</sub>	14. 9R03074	Fitting, Straight, 1/8-inch Pipe to 3/16-inch Tube	24. 9R03075	Fitting Elbow, 1/8-inch Pipe to 3/16-inch Tube
6. 3606015	Anesthesia Apparatus Pressure Regulator and Gauge, Nitrous Oxide, McKesson	15. 9R03044	Gauge, High-pressure, O <sub>2</sub>	25. 9R02974	Tube, Oxygen Supply, Complete: With metal end connections
7. 9R02936	Tube, Glass, Flowmeter	16. 9R02970	Valve, Needle, O <sub>2</sub> , Complete: Assembly	26. 9R03487	Chapin, Link
8. 9R02938	Gasket, Flowmeter Tube, Rubber	17. 9R02992	Flowmeter, O <sub>2</sub> , Complete: Assembly	27. TR00007	Wrench, Tank and Yoke, Anesthesia
9. 9R02994	Flowmeter, N <sub>2</sub> O Complete: Assembly	18. Flowmeter Nozzle, Part of 9R02998	Float and Nozzle, O <sub>2</sub>	28. 9R03134	Washer, Fiber, Small
		19. 3606020	Anesthesia Apparatus Pressure Regulator and Gauge Oxygen, McKesson	29. 9R03012	Yoke, Tank, Complete: Assembly
				30. 9R02916	Gasket, Absorber to Head

Figure 15. Item No. 9350000 anesthesia apparatus, portable: manufactured by McKesson Appliance Company.





Med. Dept.

No. Nomenclature

1. 9R03165 Upright, Base Section
2. 9R03170 Spring, Caster Locking Assembly
3. 9R03172 Pin, Locking, Caster Assembly
4. 9R03165 Base Casting
5. SR00715 Screw,  $\frac{3}{8}$ -16 x  $1\frac{1}{8}$  inch, Thumb, 144 to Pkg.
6. 9R03176 Wheel, Caster

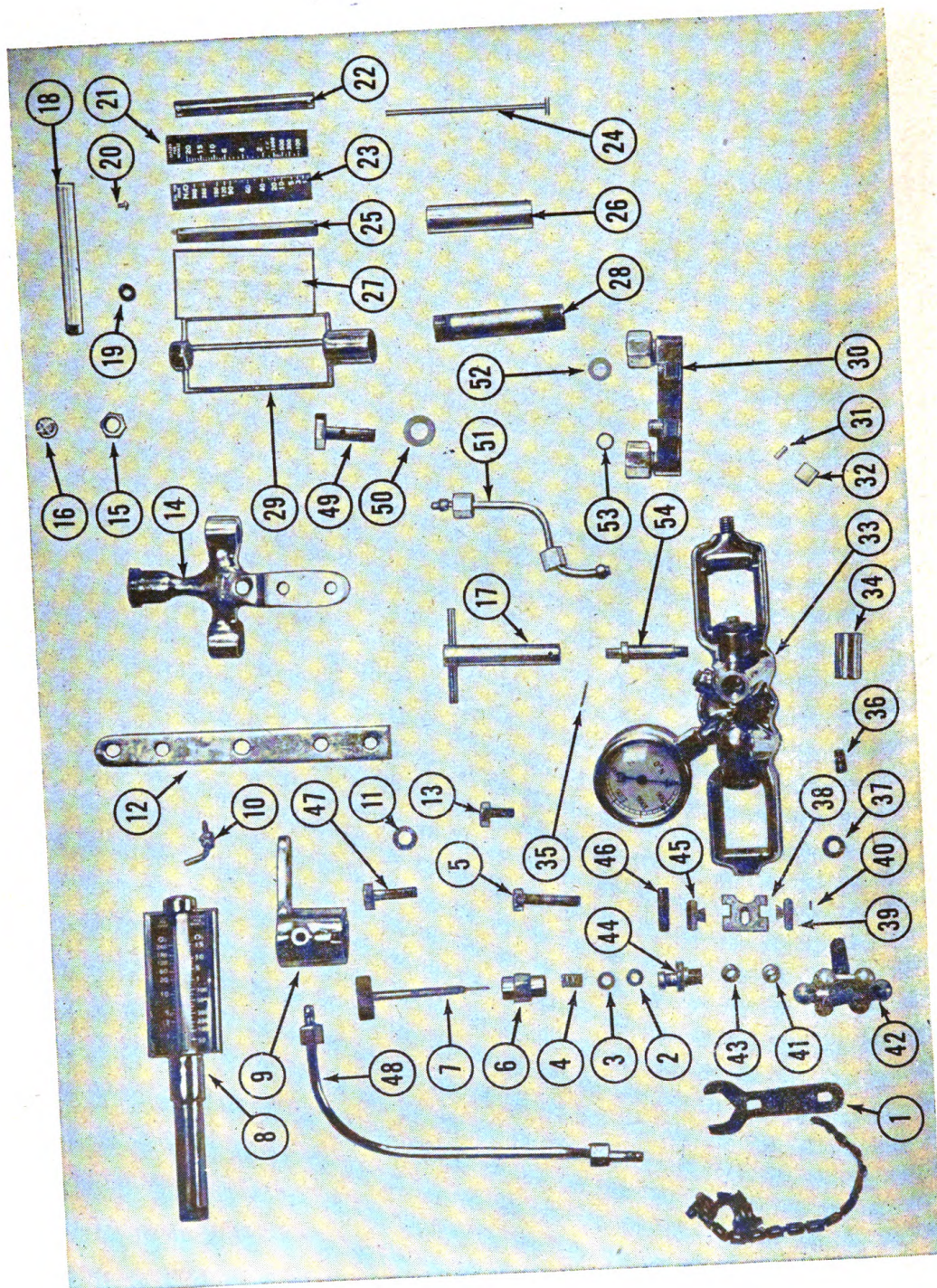
Med. Dept.

No. Nomenclature

7. 9R03177 Caster, Assembly: Without wheel.
8. 9R03173 Nut, Hex, Caster
9. SR00229 Washer, Lock, Screw Size  $\frac{1}{4}$ , 1,000 to Pkg.
10. 9R03175 Axle, Caster
11. 9R03171 Knob, Knurled, Caster Locking Assembly
12. 9R03169 Retainer, Caster Spring

Figure 16. Item No. 9350000 anesthesia apparatus, portable: manufactured by Heidbrink Division of the Ohio Chemical & Mfg. Co.







Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. TR00009	Wrench, Plug and Yoke, Anesthesia	18. 9R03112	Tube, Flowmeter, Glass	37. 9R03134	Washer, Fiber, Small
2. 9R03142	Disk, Packing	19. 9R03204	Gasket, Flowmeter Tube, Rubber	38. 9R03183	Body, Yoke Stabilizer
3. 9R03195	Cup, Packing	20. SR00472	Screw, 2-56 x 1/8 Inch, R.H.M., 144 to Pkg.	39. 9R03184	Arm, Yoke Stabilizer
4. 9R03194	Spring, Needle Valve	21. 9R03116	Scale, Flowmeter, N <sub>2</sub> O, Liters per Minute	40. 9R03182	Pin, Threaded, Stabilizer
5. SR00713	Screw, 5/16-24 x 1 1/2 Inch, Hex Head, Cap, 144 to Pkg.	22. 9R03206	Clip, Flowmeter Scale Fastener	41. 9R03199	Seat, Needle Valve, Copper
6. 9R03193	Nut, Cap, Hex, Needle Valve	23. 9R03117	Scale, Flowmeter, N <sub>2</sub> O, Gallons per Hour	42. 9R03224	Handwheel, Yoke
7. 9R03140	Stem, Needle Valve	24. 9R03122	Rod, Flowmeter, N <sub>2</sub> O Indicating	43. 9R03198	Retainer, Needle Valve Seat, Brass
8. 9R03200	Flowmeter, 0., Complete: Assembly	25. 9R03206	Clip, Flowmeter Scale Fastener	44. 9R03196	Guide, Stud, Hex, Needle Valve
9. 9R03223	Collar, Connecting, Head and Upright	26. 9R03209	Sleeve, Flowmeter Shaft	45. 9R03184	Arm, Yoke Stabilizer
10. 9R03225	Hook, Chain and Wrench	27. 9R03205	Window, Flowmeter Scale	46. 9R03185	Screw, Adjusting, Stabilizer Yoke
11. 9R03197	Washer, Hex Stud Guide, Needle Valve	28. 9R03211	Shaft, N <sub>2</sub> O Flowmeter	47. SR00716	Screw, 5/16-24 x 1 Inch, Hex Head, Cap 144 to Pkg.
12. 9R03222	Bar, Support, Head Assembly	29. 9R03208	Body, N <sub>2</sub> O Flowmeter Assembly	48. 9R03156	Tube, Supply N <sub>2</sub> O
13. SR00714	Screw, 5/16-24 x 1 1/2 Inch, Hex Head, Cap, 144 to Pkg.	30. 9R03215	Manifold, Flowmeter Assembly	49. 9R03213	Bolt, Hex, 3/8-24 x 1 1/4 Inch, Hollow: For flowmeter bar
14. 9R03221	Bar, Flowmeter Assembly	31. 9R03190	Spring, Yoke Check Valve	50. 9R03214	Washer, Hex Bolt, Steel
15. 9R03202	Nut, Cap, Flowmeter	32. 9R03189	Valve, Check, Plastic: For yoke	51. 9R03158	Tulca, Supply, O.
16. 9R03203	Screw, Retaining, Flowmeter Glass Tube	33. 9R03180	Yoke, Needle Valve and Gauge Complete, N <sub>2</sub> O: Assembly	52. 9R03120	Gasket, Flowmeter, Copper
17. 9R03227	T Handle, Head Holding Screw	34. 9R03186	Plug, Yoke	53. 9R03212	Ring, Float Retaining, Copper
		35. 9R03226	Pin, Retaining, T Handle	54. 9R03228	Pin, Threaded, T Handle Assembly: For holding head to upright
		36. 9R03187	Screen, Yoke Intake		

Figure 17. Item No. 9350000 anesthesia apparatus, portable: manufactured by Heidbrink Division of the Ohio Chemical & Mfg. Co.

- | Med. Dept.<br>No. | Nomenclature                                    |
|-------------------|---|
| 1. 9R03231        | Canister, Soda Lime                             |
| 2. 9R03245        | Bezel, Retaining, Inspection Window             |
| 3. 9R03144        | Window, Inspection, Check Valve, Plastic        |
| 4. 9R03233        | Screw, Canister, Knurled, 12-24 x 1 1/8 inch    |
| 5. 9R03232        | Screw, Canister, Knurled, 12-24 x 5/8 inch      |
| 6. 9R03146        | Gasket, Check Valve Inspection Window, Rubber   |
| 7. 9R03244        | Valve, Absorber Control                         |
| 8. 9R03252        | Nut, Inspiratory Valve, Knurled                 |
| 9. 9R03124        | Gasket, Soda Lime Canister                      |
| 10. 9R03126       | Gasket, Absorber Down Tube, Rubber              |
| 11. 9R03240       | Cap, Absorber Control Valve                     |
| 12. 9R03236       | Spring, Absorber Control Handle Packing cup     |
| 13. SR00040       | Screw, 6-32 x 1/4 inch, R.H.M., 144 to pkg.     |
| 14. 9R03234       | Handle, Absorber Control                        |
| 15. 9R03235       | Nut, Packing, Hex                               |
| 16. 9R03142       | Disk, Packing                                   |
| 17. 9R03195       | Cup, Packing                                    |
| 18. SR00040       | Screw, 6-32 x 1/4 inch, R.H.M., 144 to pkg.     |
| 19. 9R03239       | Dial, Indicating, Absorber Control              |
| 20. 9R03246       | Handle, Lung Inflation Valve                    |
| 21. SR00293       | Washer, Screw Size 1/4, 1 lb. pkg., 144 Washers |
| 22. 9R03248       | Screw, Lung Inflation Valve, Knurled            |
| 23. 9R03249       | Shaft, Lung Inflation Valve                     |
| 24. 9R03253       | Cap, Pressure Limiting Valve                    |
| 25. 9R03251       | Push Rod, Lung Inflation Valve, Complete        |
| 26. 9R03258       | Spring, Pressure Limiting Valve                 |
| 27. 9R03259       | Disk, Pressure Limiting Valve, Metal            |
| 28. 9R03148       | Disk, Check Valve                               |
| 29. 9R03247       | Spring, Lung Inflation Valve                    |
| 30. 9R03267       | Casting, Absorber                               |
| 31. 9R03261       | Cap, Threaded, Breathing Bag Port               |
| 32. 9R03242       | Nut, Locking, Hex, Absorber Control Valve       |
| 33. 9R03243       | Spring, Absorber Control Valve                  |

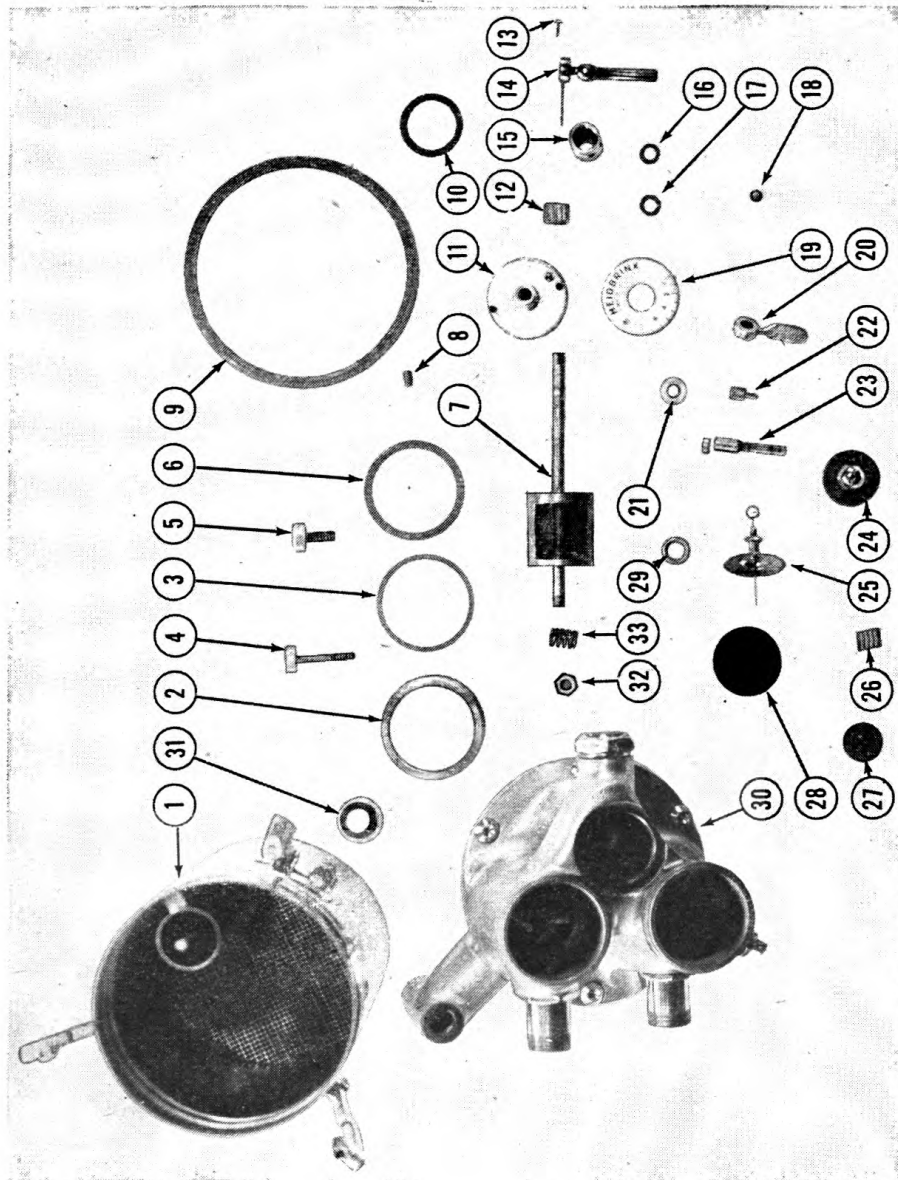
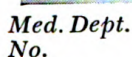


Figure 18. Item No. 9350000 anesthesia apparatus, portable: manufactured by Heidbrink Division of the Ohio Chemical & Mfg. Co.



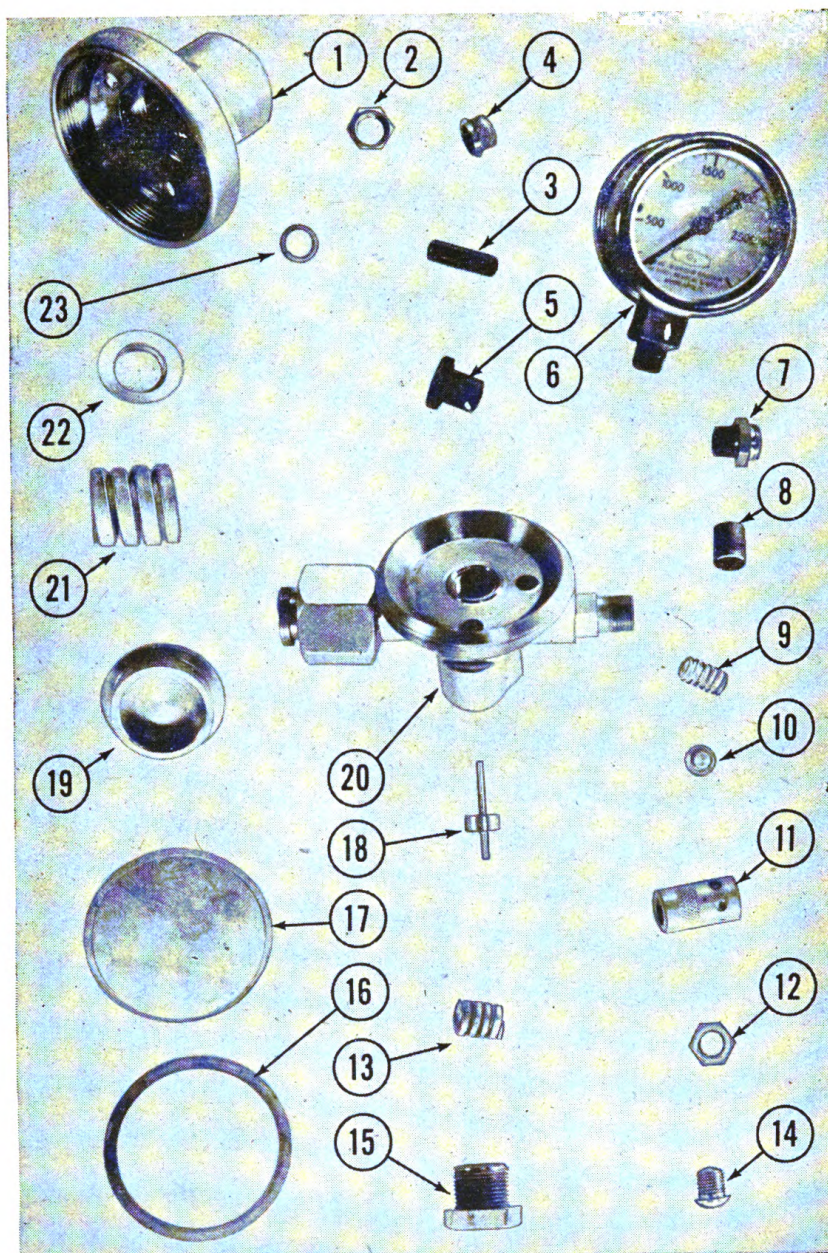
1. 9R03287 Ring, Retaining, Threaded, Knurled, Ether Vaporizer
2. 9R03284 Cup, Packing, Ether Vaporizer Valve Stem
3. 9R03282 Nut, Cap, Packing, Hex, Ether Vaporizer
4. 9R03283 Spring, Packing, Ether Vaporizer Valve Stem
5. 9R03280 Nut, Locking, Hex
6. 9R03281 Disk, Ratchet
7. 9R03277 Screw, Retaining Handle Spring
8. 9R03278 Spring, Handle, Ether Vaporizer
9. 9R03279 Pin, Stabilizing, Handle, Fiber
10. SR00718 Screw, 3-36 x 1/8 inch, R.H.M., 144 to pkg.
11. 9R03271 Screw, Retaining, Funnel Plug
12. 9R03272 Spring, Funnel Plug
13. 9R03273 Ball Check, Funnel Plug
14. 9R03270 Body, Funnel Plug, Knurled
15. 9R03274 Gasket, Funnel Plug, Leather

Med. Dept.  
No.

16. 9R03275 Pin, Retaining, Vaporizer Control Handle
17. 9R03276 Handle, Vaporizer Control
18. 9R03269 Wick, Ether Jar
19. 9R03110 Gasket, Ether Jar, Rubber
20. 9R03108 Jar, Ether
21. 9R03291 Seat, Large Valve, Brass
22. 9R03295 Body, Ether Vaporizer
23. 9R03293 Seat, Small Valve, Brass
24. 9R03294 Stem, Ether Vaporizer Valves, Complete
25. 9R03288 Disk, Valve Stem Guide
26. 9R03290 Ring, Retaining, Large Valve Seat
27. SR00717 Screw, 2-56 x  $\frac{3}{16}$ , R.H.M., 144 to pkg.
28. 9R03289 Gasket, Valve Stem Guide, Lead
29. 9R03286 Plate, Indicating, Ether Vaporizer Control
30. 9R03292 Spring, Large and Small Valve Seats
31. SR00182 Screw, 6-32 x  $\frac{1}{4}$  inch, R.H.M., Brass, 144 to pkg.

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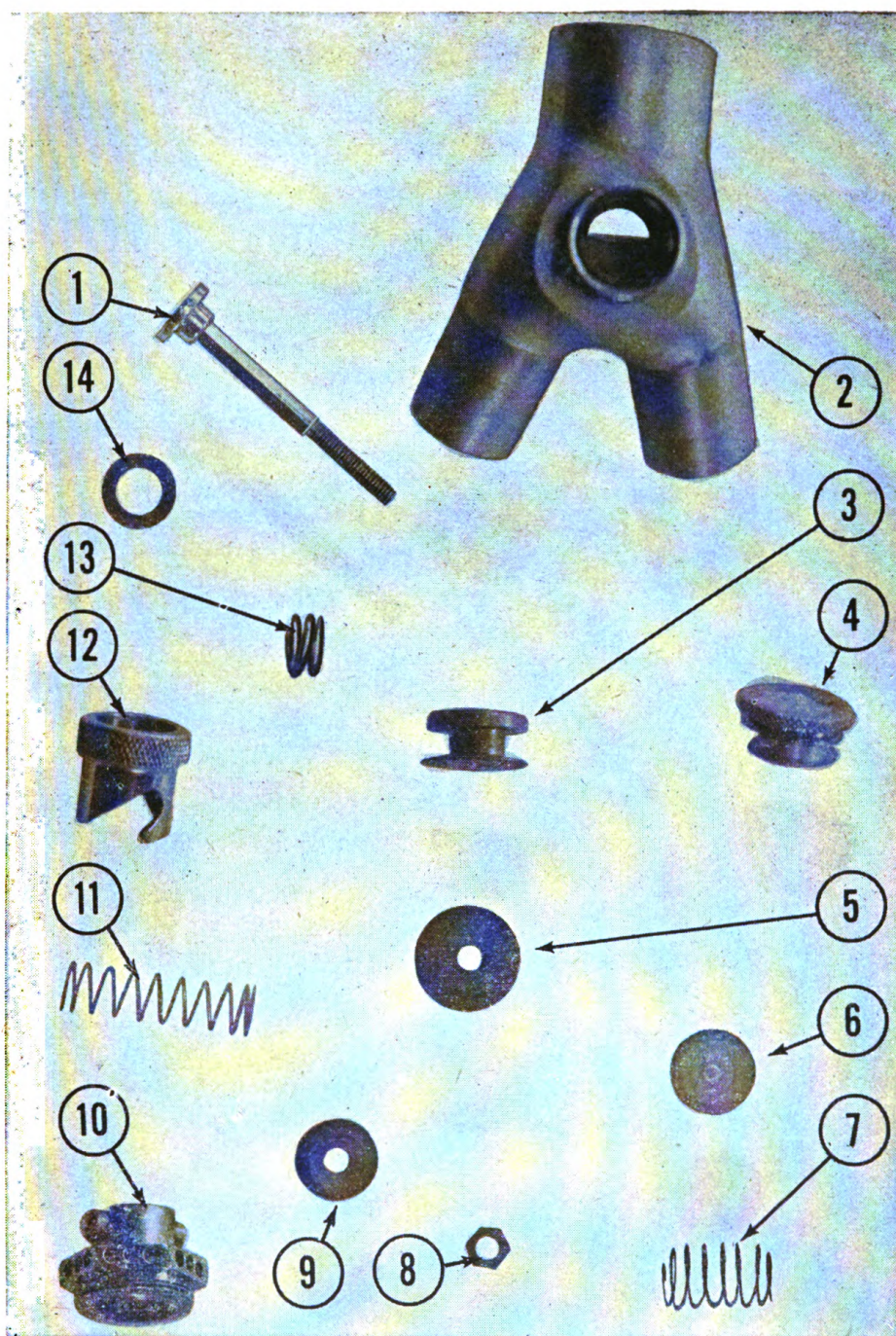




- | <i>Med. Dept.</i><br><i>No.</i> | <i>Nomenclature</i>                                  | <i>Med. Dept.</i><br><i>No.</i> | <i>Nomenclature</i>                                |
|---------------------------------|--|---------------------------------|--|
| 1.                              | 9R03305 Cap, Bell, Regulator                         | 12.                             | 9R03317 Nut, Locking, Regulator Safety Valve       |
| 2.                              | 9R03302 Nut, Locking, Hex, Regulator Adjusting Screw | 13.                             | 9R03311 Spring, Regulator Valve Seat               |
| 3.                              | 9R03304 Screw, Adjusting, Regulator                  | 14.                             | 9R03318 Screw, Adjusting, Regulator Safety Valve   |
| 4.                              | 9R03301 Cap, Regulator Adjusting Screw               | 15.                             | 9R03310 Nut, Cap, Hex, Regulator Valve Seat        |
| 5.                              | 9R03312 Nozzle, Regulator                            | 16.                             | 9R03309 Gasket, Regulator Diaphragm, Copper        |
| 6.                              | 9R03162 Gauge, High Pressure, O <sub>2</sub>         | 17.                             | 9R03130 Diaphragm, Regulator, Copper               |
| 7.                              | 9R03139 Nozzle, Safety Valve, Hex                    | 18.                             | 9R03128 Seat, Regulator                            |
| 8.                              | 9R03132 Seat, Regulator Safety Valve                 | 19.                             | 9R03308 Cap, Distributing, Diaphragm Spring        |
| 9.                              | 9R03315 Spring, Regulator Safety Valve, Steel        | 20.                             | 9R03313 Body, Regulator                            |
| 10.                             | 9R03316 Cap, Spring, Regulator Safety Valve          | 21.                             | 9R03307 Spring, Diaphragm, Regulator Valve         |
| 11.                             | 9R03314 Body, Regulator Safety Valve, Knurled        | 22.                             | 9R03306 Cap, Diaphragm Spring                      |
|                                 |  | 23.                             | 9R03303 Washer, Locking, Regulator Adjusting Screw |

Figure 20. Item No. 9350000 anesthesia apparatus, portable: manufactured by Heidbrink Division of the Ohio Chemical & Mfg. Co.





- | <i>Med. Dept.<br/>No.</i> | <i>Nomenclature</i>                           | <i>Med. Dept.<br/>No.</i> | <i>Nomenclature</i>                             |
|---------------------------|---|---------------------------|---|
| 1. 9R03339                | Stem, Face Inhaler Y Valve                    | 8. 9R03331                | Nut, Hex, Face Inhaler Y, Brass                 |
| 2. 9R03343                | Body, Face Inhaler Y                          | 9. 9R03332                | Disk, Valve Seat, Brass                         |
| 3. 9R03334                | Head, Valve, Face Inhaler Y                   | 10. 9R03330               | Nut, Hex, Perforated, Face Inhaler Y            |
| 4. 9R03340                | Cap, Face Inhaler Y Expiratory Valve, Knurled | 11. 9R03335               | Spring, Valve Head                              |
| 5. 9R03333                | Seat, Face Inhaler Y Valve Head: Rubber       | 12. 9R03336               | Knob, Knurled, Face Inhaler Y                   |
| 6. 9R03342                | Seat, Face Inhaler Y Expiratory Valve         | 13. 9R03337               | Spring, Face Inhaler Y Valve Stem               |
| 7. 9R03341                | Spring, Face Inhaler Y Expiratory Valve       | 14. 9R03338               | Washer, Face Inhaler Y Valve Stem Spring, Steel |

Figure 21. Item No. 9350000 anesthesia apparatus, portable: manufactured by Heidbrink Division of the Ohio Chemical & Mfg. Co.



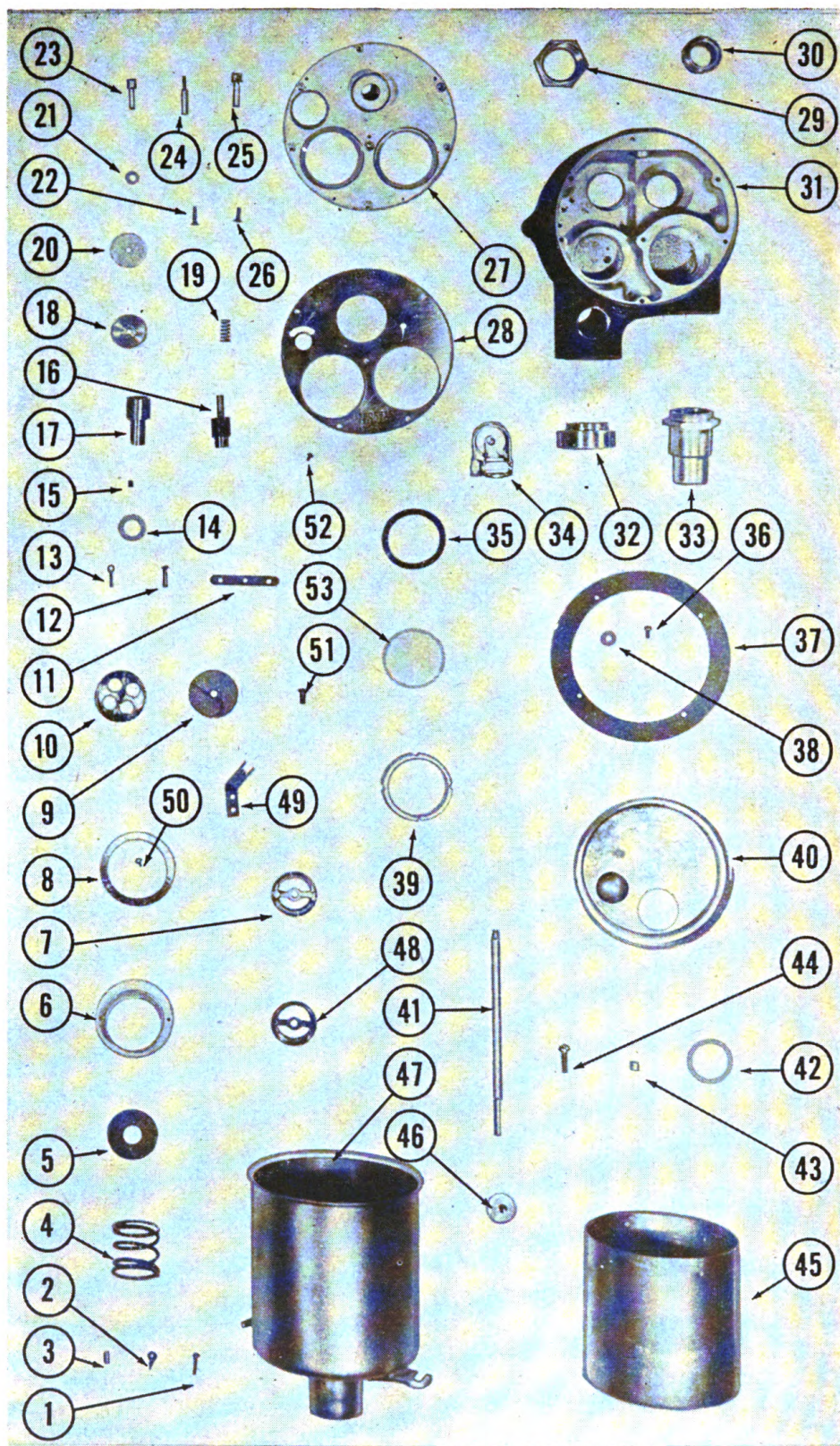


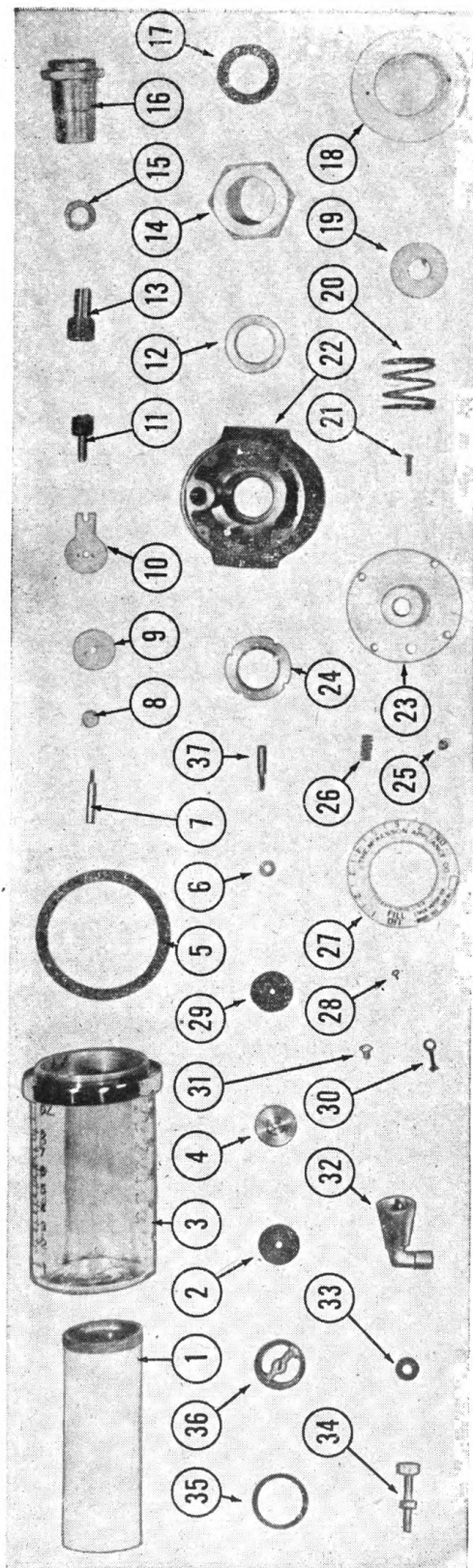
Figure 22. Item No. 9350000 anesthesia apparatus, portable: manufactured by McKesson Appliance Company.

<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>
1. SR00590	Screw, 3-48 x 1/2 inch R.H.M., Brass, 144 to Pkg.
2. 9R03084	Pointer, Absorber Control Knob
3. 9R03083	Spacer, Pointer, Metal
4. 9R03087	Spring, Absorber Control Knob
5. 9R03086	Washer, Control Knob Spring, Copper
6. 9R03085	Knob, Absorber Control
7. 9R03410	Seat, Valve Assembly, Long
8. 9R03088	Dial, Plate, Absorber Control Knob
9. 9R02954	Disk, Check Valve
10. 9R03083	Carrier and Seat, Absorber Check Valve, Brass
11. 9R03096	Bar, Valve Holder
12. 9R03097	Holder, Valve, Sleeve Pivot
13. 9R03098	Pin, Cotter, Valve Holder
14. 9R03099	Gasket, Fiber, Absorber Adjusting Stem
15. SR00233	Set screw, 8-32 x 1/4 inch, Allen, Cup Pt., 100 to Pkg.
16. 9R03095	Screw, Adjusting, Absorber Control
17. 9R03094	Stem, Adjusting, Absorber Control
18. 9R03401	Carrier, Absorber Valve
19. 9R03402	Spring, Tension
20. 9R03403	Disk, Absorber Control Valve, Fiber
21. 9R03404	Washer, Absorber Control Valve Disk, Metal
22. 9R03091	Screw, Tapered, Sheet Metal, 4 x 1/16 inch
23. 9R03405	Sleeve, Valve Holder, Short
24. 9R03407	Screw, Valve Holder
25. 9R03408	Sleeve, Valve Holder, Long
26. 9R03091	Screw, Tapered, Sheet Metal, 4 x 1/16 inch

<i>Med. Dept.</i> <i>No.</i>	<i>Nomenclature</i>
27. 9R03090	Plate, Absorber
28. 9R03089	Plate, Name, Complete
29. 9R03426	Nut, Union, Absorber to Head
30. 9R03427	Tailpiece, Absorber Union Nut
31. 9R03428	Body, Absorber
32. 9R03424	Adaptor, Ether Vaporizer
33. 9R03430	Adaptor, Breathing Tube
34. 9R03412	Valve, Exhalation, Complete: Assembly
35. 9R02950	Gasket, Inspection Window
36. SR00104	Screw, 8-32 x 3/16 inch, R.H.M., 144 to Pkg.
37. 9R02960	Gasket, Bag Holder: Rubber
38. 9R03079	Washer, Bag Holder Gasket, Brass
39. 9R03092	Retainer, Window
40. 9R03080	Retainer, Soda Lime Canister
41. 9R03072	Rod, Clamp, Bag Holder
42. 9R03081	Ring, Locking, Canister Retainer
43. 9R03082	Spacer, Canister Retainer
44. SR00587	Screw, 10 x 1 1/16 inch, Sheet Metal, R.H., Type Z, 144 to Pkg.
45. 9R03078	Canister, Soda Lime
46. 9R02946	Nut, Thumb, Knurled
47. 9R02934	Holder, Bag Assembly
48. 9R03409	Seat, Valve Assembly, Short
49. 9R03408	Guide, Absorber
50. SR00577	Screw, 2 x 1/8 inch, Sheet Metal, R.H., 144 to Pkg.
51. 9R03411	Stud, Check Valve
52. SR00588	Screw, 2 x 1/4 inch Sheet Metal, R.H., Type Z, 144 to Pkg.
53. 9R02952	Window, Inspection, Check Valve, Glass

Figure 22—Continued.





Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature	Med. Dept. No.	Nomenclature
1. 9R03433	Wick, Ether, Complete	14. 9R03434	Nut, Union, Hex, Ether Vaporizer	26. 9R03402	Spring, Tension
2. 9R03456	Disk, Shut-off, Fiber	15. 9R03444	Seal, Adjusting Stem	27. 9R03438	Dial, Ether Vaporizer
3. 9R02962	Jar, Ether Vaporizer	16. 9R03430	Adapter, Breathing Tube	28. SR00577	Screw, 2 x 1/8 inch, Sheet Metal, R.H., 144 to Pkg.
4. 9R03455	Disk, Valve, Brass	17. 9R03026	Gasket, Absorber to Ether Vaporizer	29. 9R03448	Disk, Valve, Fiber
5. 9R02930	Gasket, Ether Jar, Cork	18. 9R03439	Knob, Control, Vaporizer	30. 9R03437	Indicator, Dial
6. 9R03449	Washer, Valve Disk, Brass	19. 9R03440	Washer, Control Knob Spring, Copper	31. SR00580	Screw, 3-48 x 1/2 inch, R.H.M., Brass, 144 to Pkg.
7. 9R03450	Rod, Spacing, Valve	20. 9R03441	Spring, Vaporizer Control, Knob	32. 9R03436	Funnel, Ether
8. 9R03449	Washer, Valve Disk, Brass	21. SR00554	Screw, 4 x 1/2 inch, Sheet Metal, FL.H., 144 to Pkg.	33. 9R03034	Washer, Funnel Plug, Leather
9. 9R03448	Disk, Valve, Fiber	22. 9R03459	Body, Vaporizer	34. 9R03038	Plug, Funnel, Ether Jar
10. 9R03447	Disk, Upper Valve, Metal	23. 9R03442	Plate, Vaporizer	35. 9R03458	Stim, Lower Valve
11. 9R03446	Screw, Adjusting Stem, Vaporizer	24. 9R03451	Seat, Upper Valve	36. 9R03457	Seat, Lower Valve
12. 9R03435	Bushing, Vaporizer Union Nut	25. 9R03443	Cheek, Ball, Steel, Vaporizer	37. 9R03452	Screw, Valve Holder
13. 9R03445	Stem, Adjusting, Vaporizer				

Figure 23. Item No. 9350000 anesthesia apparatus, portable; manufactured by McKesson Appliance Company.



